MINUTES

OF THE

40th MEETING

OF THE

CEOS WORKING GROUP ON
INFORMATION SYSTEMS AND SERVICES

(WGISS)

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List of Participants

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CEOS-SEO Brian Killough\*

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CSIRO Robert Woodcock

DLR Katrine Molch

ESA Mirko Albani, Yves Coene\*, Olivier Barois\*, Guido Colangeli\*, Andrea Della Vecchia\*, Pascal Gilles\*, Rosemarie Leone\*, Cristiano Lopes\*, Iolanda Maggio\*, Philippe Mougnaud\*, Pierre Potin

GEO Secretariat Osamu Ochiai\*

Geoscience Australia Simon Oliver

GSDI/HUNAGI Gábor Remetey-Fülöpp

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NASA Andrew Mitchell (WGISS Vice-chair), Dawn Lowe, Yonsook Enloe, Lingjun Kang\*,

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NOAA Martin Yapur\*, Ken McDonald\*

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UKSA Beth Greenaway, Chris Hall, Charles McCausland, Wyn Cudlip

UNOOSA Lorant Czaran\*

USGS Kristi Kline, Thomas Cecere\*

WGCapD Eric Wood (USGS)\*, Jane Olwoch (SANSA)\*

Invited Guests Philip Kershaw (RAL Space), David Giaretta\* (RAL Space), Antony Wilson (RAL Space), Steve Donegan (RAL Space), Richard Hilton (SA Catapult), Richard Lowe (Telespazio/Vega), Francesco Liucci (Weathersafe Ltd.), Luciano Ammenti\* (Biblioteca Apostolica Vaticana)

\* Via web conference or email

# WGISS Plenary Session, Part I

## Welcome, Introductions, Adoption of Agenda

Richard Moreno (WGISS Chair) welcomed the participants to WGISS-40. Richard thanked Wyn Cudlip for all the excellent arrangements for the meeting, and asked those present to introduce themselves. He reviewed the agenda and it was adopted with no significant modifications.

## Logistics Information

Wyn welcomed the WGISS-40 participants to Harwell and the Satellite Applications Catapult, and described the logistics of the meeting for Wi-Fi, lunch, breaks, group photo, evening activities, and transportation.

## Host Opening Address [[presentation]](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_09.15_Host_Opening_Address.pptx)

Beth Greenaway, Head of Earth Observation at the United Kingdom Space Agency (UKSA) welcomed the participants on behalf of the UKSA. She spoke on the topic of maximizing the potential of Earth Observation for the benefit of the economy, science and society. She described the UK Space Gateway at Harwell where the meeting took place. She noted that public support plays a strong role in creating conditions for investment, so UKSA is putting a lot of investment into this, adding that there are over 100 foreign-owned space firms in the UK.

The UK Space agency has changed a lot over the last few years, leading to an executive agency with roles in leadership, policy, education, science, technology, innovation, investment, and partnership. The role for business growth is key, as space technology offers much growth potential. A large fraction of their budget goes to ESA.

UKSA’s domains are space science, planetary exploration, EO, meteorology, space situational awareness, telecommunications, navigation, applications and services, and manned space; they have just sent their first astronaut to the International Space Station. The UKSA is driven by space innovation and growth strategy, in collaboration with the government, looking toward growth in market share, manufacture, services and applications, so society can benefit from space data.

The EO strategic implementation plan is designed on the assumption that EO applications and services will be central to space-enabled economic growth aiming for a 10% share of the expected £400 billion global space-enabled market in 2030. The plan runs until 2017 and is an internal prioritization tool.

The EO priority actions are to define and lead EO strategy and policy development, to enable growth of the EO and related sectors, to position the UK as a global leader in use of EO in applications and services, and to be sector sponsor for the EO community, both nationally and internationally. Ms. Greenaway displayed a diagram of space infrastructure, highlighting a critical arrow connecting the users who need the information and services with the start of the process (i.e. user driven space assets).

UK strengths are satellite manufacture, data handling and cal/val, applications, and getting space data used in operational services. She listed several examples of EO technology developments, and listed UK ground segment infrastructure in civil institutional organizations and universities.

Ms. Greenaway pointed out that data is the new resource, as massive amounts become available for people to access from the Sentinel missions. The Satellite Applications Catapult will house the rolling archive of Sentinel-1 data. The UK Space Agency has three pillars of engagement: national initiatives, ESA, and international space partnerships.

Finally, EO is an essential component of the infrastructure and a contributor of economic growth, data and science. It is a Key Performance Indicator (KPI) for the Agency. Success for UKSA requires growing existing UK strengths, seizing new markets and engaging the public sector as operational users. Technology and business models are changing, and partnerships are essential to deliver operational services to realize the benefits of EO.

Ms. Greenaway thanked WGISS for coming to the UK and Harwell, and wished the participants a successful meeting.

## WISP Report [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_10.05_WISP_Report.pptx)]

Michelle Piepgrass gave the report on behalf of the WGISS Infrastructure Services Project. Martin Yapur leads the team, which also includes Anne Kennerley and Kim Holloway. She gave instructions for uploading and naming presentations, adding that the presentations will be available by opening links on the WGISS-40 agenda posted on the WGISS website.

WISP has been active updating the WGISS webpage and adding WGISS documents in the CEOS Document Management System (DMS). Efforts are also underway to overhaul the WGISS email lists. WISP seeks the support of WGISS members to continue managing the main content of the WGISS website and the mailing lists, and to generate and support outreach materials.

## WGISS Chair Report [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_10.15_WGISS_Chair_Report.pptx)]

Richard Moreno reported on the SIT Technical Workshop 2015, WGISS-40, and CEOS Plenary 2015.

He described highlights of the Technical Workshop, held 15th to 18th September 2015. The agenda and documents are available at <http://ceos.org/meetings/2015-sit-technical-workshop/>. Key elements included side meetings for the Land Surface Imaging Virtual Constellation (LSI VC), for Water Strategy, and a VC/WG working day. Informal actions for WGISS are to present more precisely the Purge Alert procedure during the next CEOS SEC teleconference, and to increase cooperation with other groups, such as LSI, WGCapD, WGClimate, WGCV, SEO, and GEO. The outgoing SIT team is CNES, and the incoming team is ESA.

Richard showed a diagram of the organizational structure of WGISS explaining that activities are divided between interest groups and projects; projects usually have a start and end point, and interest groups are ongoing. He commented that the organizational structure on the website is out of date; the Interoperability Interest Group, which is an umbrella of IDN, CWIC, OpenSearch, FedEO, is missing, and noted that the Virtual Constellations Interest Group does not currently have clearly defined activities.

Topics to be covered at the CEOS Plenary 2015 related to WGISS are a video being prepared by WGISS illustrating OpenSearch/ Interoperability. WGISS will also present and endorse the data purge alert procedure. A high point of the meeting will be the incoming chair initiatives:

1. A study of non-meteorological applications for next generation of geostationary satellites.
2. A study of future data access and analysis architecture. The data architecture effort seeks to fold in ongoing or planned work within WGISS, GFOI/SDCG, and the LSI VC.

## CEOS Executive Officer (CEO) Team Report [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_11.00_CEOS_Executive_Officer_Report.pptx)]

Jonathon (Jono) Ross, Deputy CEO, reported on behalf of the CEO team. He reported on GEO and on the CEOS Work Plan.

**GEO**: The future of GEO includes a focus on delivering impact into big global and regional agendas – in particular the Sustainable Development Goals, and on developing stronger and more explicit links with UN institutions and programmes. There will be an emphasis on mobilizing resources from the private sector, development banks, and philanthropic organizations. CEOS seeks to harness this to support CEOS agency activity. There will also be an emphasis on defining and prioritizing requirements by SBA, with deeper end-user engagement, and a strong focus on in-situ coordination and space/in-situ integration.

Jonathon reported that it is still unclear what the GEO work plan will contain. It is expected that the GEO work programme will have a specific element for space EO, and all the old boards will disappear. A great emphasis on DMPs (Data Management Principles) is expected, and a shift from pilots to operations. CEOS has learned a lot from the carbon actions; some of the actions were quite daunting and needed to have proposed next steps. The key is to make a start, and make progress, breaking down the problem into manageable steps.

Andrew (Andy) Mitchell asked if CEOS will change the way it tracks the action items. Jono said that the existing tracking system is quite flexible; he does not expect problems if dates or other aspects need to be changed, or if tasks need to be broken into smaller pieces.

CEOS is also in the process of preparing to respond to the GEO water strategy, and is working with the UN and GEO to promote space data. Everyone needs to be able to suggest suitable methods to exploit space data. He added that data access to the climate community is key, and provides a good opportunity to highlight the work CEOS is doing.

**CEOS**: Jono announced that CEOS-29 is in November in Kyoto, and CSIRO will become Chair. CEOS will be accepting five applications to join, from five different continents, and most of the agencies explicitly said they would like to work in data exploitation. The CEOS Workplan tracking is giving the general impression of progress towards the objectives that are due before or shortly after Plenary 2016. Monitoring progress is easier where there are clear steps. Jono gave the timeline for the work plan update, which will be updated with priorities set at CEOS-29; version 1.0 is expected 28 February 2016. He concluded saying that if WGISS wants to do something new, or stop doing something, it needs to be brought to the CEOS Plenary.

## GEO Secretariat Report [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday09.28_11.30_GEO_Secretariat_Report.pptx)] [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_12.00_GEO_Work_Plan.pptx)]

Osamu Ochiai gave the GEO Secretariat report. He discussed the GEO Strategic Plan 2016-2025, and the new GEO Work Programme.

The Strategic Plan began developing at the beginning of 2015, with a new version distributed recently. It includes a section on strategy, one on implementation, and a number of reference documents. Part A includes the Vision for GEO, GEO’s mission, and GEO’s value. SBAs have a new structure; there are eight SBAs, with climate change and its impacts as cross-cutting and connected to several SBAs. Part B seeks to implement the strategy of A, leveraging the successes of the first decade. GEO will implement the Data Sharing Principles and the Data Management Principles.

The core functions of Part B include identifying user needs, addressing gaps in the information chain, sustaining foundational observations and data, fostering partnerships to mobilize resources, and advancing GEOSS and best practice in data management and sharing. Additional functions are implementing sustained global and regional services and cultivating awareness, building capacity and promoting innovation. The implementation plan consists of GEO Foundational Tasks directed at GEO community activities, GEO initiatives, and GEO flagships.

The GEO 2016 transitional Work Programme covers the new GEO decade 2016-2025. It is being developed in parallel with the new Strategic Plan in order to have the necessary tool in place to ensure continuity to GEO actions in 2016. This transitional plan bridges the first and the second GEO decades and ensures continuation of current activities and inclusion of new ones. In addition to the transitional plan, there will be 3-Year regular work programmes for 2017-19, 2020-22 and 2023-25. The Work Programme includes 18 foundational tasks, 20 GEO initiatives, and 33 community activities; all current SBAs are addressed.

Osamu displayed a list of the current community activities (numbered “CA-01”, etc.), the GEO initiatives (numbered “GI-01”, etc.), and the foundational tasks (numbered “GD-01”, “CD-01” and “SO-01”, etc.). He asked the participants to note GD-03 and GD-07:

GD-03: Global Observing and Information Systems (includes systems like WIGOS. GCOS; …. And reference datasets)

GD-07: GCI Development (includes development of Data Management guidelines).

Osamu showed the general description, the implementation approach, and the respective responsibilities of these two tasks. WGISS can take an active role in these.

Osamu reported that the GEO WP 2016 v 4.0 has been released and will be presented at GEO –XII in November; inputs from delegations will be incorporated in version 5.0 which will be released mid-December.

Osamu listed the participants in the GEOSS Common Infrastructure (GCI), and gave statistics of the current GEOSS resources. Mirko Albani commented that the CEOS contribution is not quite correct; Yonsook Enloe added that WGISS is developing a page on the WGISS website that will contain clear, regularly updated metrics of the CEOS contribution.

Richard asked if the IN-02-C1 task is being replaced by the GD-03 and GD-07 foundational tasks. Osamu said there will be a mapping provided with the work plan. Richard stated that WGISS is interested to work with GEO, but clear information is needed. He asked Osamu if he could prepare for WGISS a clear description after GEO XII. Osamu expects much discussion after the GEO Plenary to clarify the tasks. In the meantime, Osamu will send WGISS a letter confirming willingness to participate.

Beth said it is difficult to go to the CEOS Plenary and GEO Plenary without the needed information.

**Action WGISS-40-01**: Mirko Albani to follow up with Osamu after the GEO XII Plenary for the correct mapping of IN-02-C1 to GEO Task (05).

## New Themes/Priorities of Incoming CEOS Chair [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_13.30a_Incoming_Chair_Initiatives.pptx)] [[document](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_13.30b_Future_Data_Architectures.pdf)]

Richard Moreno presented the two initiatives of the incoming CEOS chair:

1. A study of Non-meteorological applications for next generation geostationary satellites

The geostationary applications effort seeks to build upon a Japan-Australia collaboration which exploits the world-first technology available on Himawari-8 - which we anticipate will have world-wide appeal as next generation GEO satellites are launched.

1. A study of Future Data Access and Analysis Architectures

The Data Architectures effort seeks to fold in ongoing or planned work within WGISS, GFOI/SDCG, and the LSI-VC. And we look forward to the contribution and cooperation of these groups as well as individual CEOS agencies with relevant interests.

Richard gave highlights of the Proposed CEOS Chair Initiative for 2016 Future Data Access and Analysis Architectures Study.

Andy commented that the key question is how WGISS can play a role, and how it can further support this one-year study; he added that the term “analysis-ready data” is not clearly defined. Robert Woodcock remarked that there is an ongoing conversation about the volumes of data, the fusion of data, modelling; a lot is happening at a global scale.

The CEOS principals have said that in the interest of making the data more accessible, WGISS should go in this direction, identifying possible solutions. A data cube is one solution; others are thematic exploitation platforms, and the “bring the user to the data, not the data to the user” concept. These methods are all trying to achieve the same goal of making data more accessible.

Antony Wilson commented that it would be very interesting to see a study showing what has been done and how the problem is being solved. ESA has found that an analysis system has to be provided along with the data.

Kristi Kline noted that at USGS they have seen a huge evolution from selling raw data to now mainstreaming processed data (like a terrain corrected datasets). Terrain correction is one more step that the user does not have to do, similar to correcting for reflectance. One big issue is data quality; the suppliers/users need to ensure that data quality is being handled before it can be used in a data cube approach. To further complicate this, archived data can be quite different, and new data (Sentinel) can involve vast quantities. The tiling issue has not really been tackled.

Satoko Miura commented that without clear core requirements, it is hard to know what the user needs; it is also difficult to bridge the gap between data provider and end user. Tom Cecere replied that the working groups and ad-hoc teams can help by clarifying what types of information member agencies could possibly provide. The LSI VC really needs to be re-established because they are the ones to look at the requirements as a whole. A big step toward getting data to the users is to eliminate 80% of the processing currently done by the users. The communication is going to be critical in this whole process.

Jono commented that other groups have already done some of this work, coming from a domain and a cross-cutting view, but it needs to be expanded across domains.

Andy noted that finite use-cases are needed and Antony wondered if a use case that cuts across domains and forces a perspective from different angles could be written, clearly outlining which user is being addressed, who wants information, and who wants data for research. Jono said that WGISS is not being asked to do this yet. What is being asked is *where* WGISS can contribute. WGISS would like to participate in the study team. This is a challenge, clearly in line with WGISS’ expertise, that may provide a road map for coming years.

Mirko asked if WGISS simply needs to confirm at the WGISS Plenary that it will contribute, and Richard suggested organizing workshop or session at WGISS-41. In the lead-up to March they will begin to identify emerging patterns, and by March should have the basis for a user engagement to begin getting into the detail. Something to present at SIT in September, and conclude at CEOS Plenary in Australia.

## WGISS Support to LSI VC and other CEOS Working Groups

Tom Cecere presented a slide from the SIT workshop showing the mission statement of the LSI Virtual Constellation, drafted in response to CEOS Action 28-04: The LSI‐VC, led by Tom Cecere (USGS), to prepare a draft implementation plan, based on the "Space Segment Coordination" Option and including a proposed update to the LSI‐VC ToR, For review Prior to, and discussion at, SIT‐30.

Richard also outlined the LSI VC Implementation Plan Framework, and listed the proposed focus themes. It will be implemented with a phased approach, in three phases.

The contribution from WGISS will be done in conjunction with the activity of the incoming chair. Kristi commented that there is a lot of overlap between this plan and the initiatives of the incoming chair, and Andy suggested that they are complementary efforts.

Tom agreed that the efforts are complementary, and said that it is deliberate. It might be worthwhile to review the ToR and look specifically at the section about working with WGISS, as it will be key.

## WGISS Response to CEOS Actions Assigned to WGISS [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_14.30a_WGISS_Response_CEOS_Actions.pptx)] [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_14.30b_SITWS2015_VCWG_Carbon_Actions_CV_WG)]

Richard Moreno began his presentation mentioning the new CEOS Deliverable Tracking Tool, at <http://www.ceos-deliverables.org/task_manager/tasks>. He presented four CEOS tasks that concern WGISS:

**Data 03 - 2015-Q4**: *Assessment of technical architectures for supporting operational programs:* *CEOS has made considerable progress in coordinating data acquisition to support important stakeholder initiatives, a number of which have a goal of becoming operational over the coming years. The challenges of routinely processing and analyzing full archives of data to produce operational products are very different to those of producing one-off example products. Traditional (clip and ship) approaches are proving not to work. This presents a significant (big data) challenge for both the user communities and the space agencies who wish to support them, but whose programs must also be sustainable. In response to this strategic challenge, WGISS will propose recommendations to SEO for exploring options for how international activities that target an operational state, such as GFOI and GEOGLAM, may be sustainably supported by CEOS and CEOS Agencies into the future. A number of pilot projects are underway that will provide important learnings. These recommendations will be a key input into broader discussions on governance, finance and management. Assigned to SEO, WGISS*

Jono commented that this is one of the topics that will come up in the Chair Initiative study, and the best way to progress is in the context of the Chair Initiative. The Chair Initiative was informed by this task.

Yonsook asked for clarification on the statement “WGISS will propose recommendations to SEO for exploring options for how …” Jono replied that this means identifying the technical options to take the SEO activities to the next level. Andy commented that making systems operational is something the agencies are experienced with, and WGISS could move forward; however, the examples given are not good ones because they are GEO tasks. Kristi commented that data delivery has been one of GEO’s biggest issues. The question that keeps being raised is whether CEOS should be developing things to become operational systems. The information needs to go to the CEOS principals. They have committed to the initiatives, and sustainability has to be considered; some of this may be in the private/commercial sector.

**VC 01 - 2015-Q4**: *List of relevant datasets from VCs: Each VC will provide WGISS with a list of relevant datasets that its respective constellation members desire to access. WGISS will work with CEOS data providers to ensure search and accessibility (when possible) of these datasets are available so as to ensure coverage of all datasets required by VCs.*

WGISS has worked successfully with some VCs that knew what products they wanted. What is needed is someone to play the role of identifying the datasets they need from what is available.

Andy suggested focusing on one VC at a time; perhaps beginning with NOAA/GHRSST. A lot of agencies are involved in the VCs.

**Action WGISS-40-02**: Andrew Mitchell and Kristi Kline to talk to the VC members at their agencies (NASA, USGS) to begin the conversation for data needs in response to VC01; by WGISS-41.

**WAT 01 – 2015-Q4**: This action is not for WGISS; it was picked up in error.

**CARB 08-35 – 2015-Q4**: *Guidelines for appropriate data use of satellite data and data products.* *The CEOS Carbon Subgroup (recommended in Carbon-Action-38) will develop guidelines for appropriate data use of satellite data and data products. This will require improved interactions between the carbon cycle community and the satellite community; comprehensive review of the current use of data products, including current data limitations; and reconciliation of methodological differences and spatial compatibility. Such interactions may include co-sponsorship of joint workshops targeting specific data needs and investment in community product assessments, especially for key inter-comparison exercises.*

Kristi commented that the bigger issue is that when a user performs a search, too many results are returned; there is nothing that says “this is the best one to use”. WGISS could put forward a proposal for such a system; there needs to be a different step/capability for search relevancy. It would be nice to give information to the user more about the quality of the data, and what has been done to verify the quality of the data.

Tamara Ganina said that her agency is working on preparing a visual that gives the user all the different characteristics so they can more easily select what they want, whether it is raw data or product.

## WGISS Response to DataCube Request for Participation

In reference to DATA 03- 2015-Q4, Richard commented that WGISS should work more closely with SEO; specifically on GFOI and GEOGLAM. Kristi suggested that a good approach would be an application of DC principles to those two projects. Richard noted that the SEO shares with WGISS on the Kenya and Colombia projects, and these are also possibilities; any activity should be in cooperation with SEO. Robert said CSIRO has a processing algorithm that they will be adding to the GEOGLAM and GFOI and hope to make it a basis for the Australian version of the GEOGLAM. Simon added that some core elements are done but a discrete project plan is in the works.

Richard asked, if someone wants to set up a DC today, what is advised? Simon recommended waiting for the version 2.0 solution. Kristi said that new approaches should be able to hook to new data, and Robert noted that it is a goal of v 2.0, as is a continuous update requirement. Andy agreed that v 2.0 could be a good starting point for WGISS.

Yonsook commented that all the use cases so far involve land use and land cover, and wondered if there are others. Simon gave as examples shallow water altimetry, coastal, water turbidity, tidal and many others, but the use cases are so disparate that it is very challenging. They are attempting to manage the use cases and categorize them by pattern rather than a thematic categorization. Simon added that the real value of a DC is anywhere it is appropriate to use time series data.

Robert commented that they have looked at what has been done (by SEO) and stepped back to analyze; that is the difference between version 1.0 and 2.0. The SEO use cases cover only a small area, but GFOI and GEOGLAM cover a much wider area.

Kristi remarked that it would be very interesting to look at what the SEO has done and see how it fits into GFOI and GEOGLAM. There are issues that need to be resolved, such as making the analysis-ready products available (accessible through CWIC). Analysis-ready is not yet considered mainstream and agencies are not prepared to operationalize it. A common baseline, a core, has to be identified that can be developed to feed the DCs. It would also be interesting to see what can be generalized from existing DCs, and identify the core elements.

Discussion regarding analysis-ready data centered on the challenges, which has a spatial component and a spectral component. Kristi noted that surface reflectance is handled a little differently by everyone. In addition, it can only be usable in a DC if there is geometric accuracy. Richard noted each agency has different reference images and orthorectification is a challenge; Kristi suggested that WGCV could provide expertise in that. Simon noted that GA has a good model. Ultimately it needs to be possible to map data pixel by pixel.

Simon added that a semantic perspective would really help to enrich the information in the DCs.

Wyn pointed out that CEOS is requesting from WGISS to avoid overlap, duplication of work, and Andy added that his interpretation is that they are looking for expertise. Richard suggested setting up a structured team in WGISS to take on this work. It was decided to create a new activity team within WGISS, with a goal to review future architectures to improve data usability with particular reference to data cube concepts. The team will be named Future Architecture for Data (FAD), and the following agencies offered to participate: GA, CSIRO, ESA, USGS, CNES, UKSA, and GSDI.

FAD purpose statement: To investigate future information system architectures for improving EO data usability, with particular emphasis on the DataCube concept.

This decision covers all the initiatives where WGISS is being asked for help except perhaps the Carbon actions.

**Action WGISS-40-03**: Regarding the incoming CEOS Chair initiatives on Future Data Access & Analysis Architectures Study, the CEOS Data 03 task, and LSI support: Future Architecture for Data (FAD) team to find where these complement, and to define areas where they do not (are independent). FAD is composed of USGS, CSIRO, GA, GSDI, ESA, CNES, UKSA, and co-chairs are Kristi Kline, Richard Moreno and Robert Woodcock.

**Action WGISS-40-04**: FAD to put together the materials of Action 40-01 to present at WGISS-41.

**Action WGISS-40-05**: FAD to work with WGClimate and WGCV to come up with a plan to approach the Carbon data search relevancy, and propose it at the next SIT meeting.

## WGISS / WGCapD Cooperation Topics [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_15.45_WGCapD_Cooperation.pptx)]

Eric Wood, Chair of WGCapD, introduced his presentation stating that at the recent SIT meeting he had conversations with Richard and Andy where they decided that it would be appropriate to have a “get to know you” session. WGCapD is exploring ways to support WGISS in its capacity and awareness building activities: Making CEOS, member institutions, and the general public aware of what WGISS is doing, and addressing WGISS mandates. WGCapD might also help develop capacity (in CEOS or general public) to utilize WGISS products or processes.

Eric listed the WG members, noting that Jane Olwoch (SANSA) will become Chair at the Plenary. He gave the background (originally WGEdu), emphasizing that they are exploring their new mandate to reach more people, meet the needs of CEOS, and focus more on Data Democracy. The four pillars of Data Democracy are data access, dissemination, software tools, and capacity development.

Eric listed their activities during the past twelve months, which include workshops, webinars, GEO support, and VC/WG support (SST-VC collaboration, WGDisasters).

WGCapD had a role in the release of the SRTM data, finding that there is an infinite need for building capacity for using the data. To that end they have had successful face-to-face workshops in Mexico and South Africa.

WGCapD is working with a webinar series on remote sensing technology for disaster management, led by INPE and ISRO; the results are promising. They are also working on capacity building for the GEONETCAB portal.

WGCapD is learning that their efforts should focus on awareness building, as opposed to teaching how to use the tools. They cannot successfully support the VCs or WGs without true collaboration.

In response to lessons learned, the group has begun a strategic planning exercise that will result in a 3-Year Work Plan and a basic restructuring of the WG.Restructuring goals are to highlight (build awareness of) new CEOS missions and datasets, and how to use the latter within the context of existing datasets or in support of CEOS/GEO projects; to increase the ability of the WGs/VCs to provide their own capacity building; to improve communications and coordination between member agency and WG/VC/CapD capacity building and education activities as well as related international activities/practitioners; and to continue to increase access to data, products, and tools and ability to use them (data democracy).

Eric showed a slide describing their understanding of WGISS, noting that it suggests opportunities for awareness building. His key questions are what capacity and awareness building has WGISS done recently, and what capacity building requirements does WGISS have in the near future and what are the plans for meeting them.

Andy responded that WGISS is developing a video demonstrating interoperability and has produced a number of documents that are on the WGISS website, and could use help getting them visibility. WGISS is not doing a great job of reporting back to its own agencies. Andy asked if they are connected with educational institutions or others where the outreach could occur. Eric replied that they have not been really active in the conference circuit due to time constraints, but are making the effort for the AGU meeting.

WGCapD are also beginning to build collaborators for webinars. Andy agreed that WGISS foresees the need for webinars. He wondered if WGISS can serve the other VCs and WGs by providing awareness and instruction on how and where to access datasets on the WGISS website; there is a wealth of information, but only a handful are aware of this.

Richard suggested an activity to promote open source software; this is a matter of collaboration.

WGISS should start with awareness building then move to capacity building. WGISS will try to identify areas of cooperation between the two WGs.

**Action WGISS-40-06**: WGISS Exec to find a few of topics of cooperation with WGCapD (awareness and capacity). Ideas are the WGISS video, or a webinar on the results of the incoming chair initiative. Demonstrate how clients to get the data.

## ­­­­WGISS Video for CEOS Plenary [[document](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150928_Monday/09.28_15.15_WGISS_Demo_Video_Storylinex)]

Yonsook Enloe reported that a team to produce a demonstration video for the CEOS Plenary, consisting of participants from CNES, ESA, and NASA, has been meeting regularly for this purpose.

The demonstration will show scientists accessing satellite data from NASA, USGS, CNES, ESA, and the European Commission using two tools. The ability to search, discover and access data from multiple CEOS agencies and perform inter-comparisons with the satellite data are valuable capabilities for scientists studying environmental issues worldwide. The use of the WGISS interoperability standards for search and access makes this possible. These tools enable advisors to use satellite data in combination with other information to study environmental issues to benefit future generations.

The first step was to develop a use-case. It was agreed to show forested and deforested areas of Borneo, and was confirmed that the data is accessible. The FedEO client will perform a collection search and then a granule search for MODIS land cover data granules. The FedEO client is shown accessing browse of Landsat data, SPOT data, and Envisat C-band data with Sentinel-1 data. The video of CWIC-Smart client is shown doing a collection search, and then accessing browse of the same MODIS, Landsat, SPOT, Envisat, and Sentinel products.

The team stated that having the video ready in time for the Plenary is an achievable goal.

# Agency and Liaison Reports

## Japan Aerospace Exploration Agency (JAXA) [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_10.45_JAXA_Agency_Report.pptx)]

Satoko Miura gave a report on current advances at JAXA. She displayed a timeline of current satellites and future missions. The mission themes include disasters and resources, climate change, and water.

The ALOS DSM (30-meter) was released on May 18. Satoko gave details on resolution, height accuracy, and composition, and added that data is available free of charge upon user registration (data download FTP). Satoko noted that color images and quicklook images are now available of the geophysical data from the geostationary satellite of Japan Meteorological Agency (JMA), Himawari-8 Monitor.

Satoko gave two examples of disaster monitoring, with GPM/DPR images on September 9-10 and ALOS-2/PALSAR-2 images showing extensive rain, riverbank collapse and flooding.

Finally, Satoko announced that the JERS-1 data distribution of archive data will become open and free by the end of October.

Jono commented how impressive the data quality of Himawari is.

## National Aeronautics and Space Administration (NASA) [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_10.45_NASA_Agency_Report.pptx)]

Dawn Lowe gave an overview of NASA data collections, platforms, and instruments, and reported new datasets and tools available at NASA’s Earth Observing System Data and Information System (EOSDIS). She began with a diagram showing the platforms and instruments currently operating, and the thematic areas that they cover. She listed their data sources, the vast majority of which is satellite, but they also have airborne missions and in-situ measurement missions. She also discussed near-real time applications support, and earth science research support (research products). She described planned, in-development and in-formulation missions, many of which are cooperative ventures. Dawn displayed a diagram showing the growth of data between 2000 and 2015.

New data sets available from EOSDIS include Soil Moisture Active Passive (SMAP) level 1 radiometer and radar data products released to the public on July 31, and Suomi National Polar Orbiting Partnership (SNPP) products using NASA algorithms. NASA’s Distributed Active Archive Centers (DAACs) will distribute the Ozone, VIIRS Land, VIIRS Ocean, VIIRS Atmosphere and sounder products.

Dawn reported that the Earthdata Search Client (EDSC) tool provides easy-to-use access to EOSDIS services for Earth science data discovery, filtering, and visualization. It was released as opensource in August. She explained that, for understanding user needs and assessing performance, EOSDIS relies on DAAC user working groups, EODIS metrics, and DAAC customer satisfaction surveys.

Dawn discussed the number of files distributed by discipline, and by international community, which rose to 1 billion in 2014. Jono asked about the metric system to obtain this information; Dawn replied that it is a manual process. She also discussed the American Customer Satisfaction Index obtained from an independent annual customer survey. In 2014 they scored 78 (out of 100). The survey results many suggestions, and the majority of users are researchers.

The driving goal of the Global Imagery Browse Services and Worldview is to transform how users interact with and discover NASA Earth data, making it visual, and allowing overlays. It is available and open source.

## Geoscience Australia (GA)/ Commonwealth Scientific and Industrial Research Organisation (CSIRO) [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_10.45_Australia_Agency_Report.pptx)]

Simon Oliver and Robert Woodcock presented a report for GA and CSIRO. Simon began with a discussion of the Geoscience Australia Data Cube (AGDC), which is a collaboration between CSIRO, GA, and Australia’s National Computational Infrastructure. The AGDC encompasses data-intensive quantitative science, supporting management and quantitative analysis of massive volumes of EO and other geoscientific data, with pixels as observations. The AGDC is a sensor-independent system for management, analysis and sharing of EO data.

The AGDC is a series of data structures and tools to enable efficient analysis of large EO archives in HPC environments. Key elements are the use of simple data structures, calibrated and standardized unique observations, quality assured observations, open source software, and analysis-ready data.

The Data Cube paradigm is “process once – use many times”, with simple data access and analysis, robust processes, and quality assured unique observations.

In addition to the three Australian partners, the AGDC has increasing involvement with international collaborators (USGS, NASA and CEOS). The AGDC is currently supporting a range of remote sensing applications across the water, vegetation and mineral domains, and providing valuable information for environmental monitoring and modelling across all Australian jurisdictions.

Simon displayed the example of the Water Observation from Space (WOfS) project, using tidal models to map tidal extents, identifying vicarious calibration sites, Landsat-MODIS blending, and GEOGLAM rangelands.

Simon listed the open data and code that is available and described details of versions 1 and 2. AGDC v2 has multidimensional storage units, ingest support for multiple sensors, PC, cloud and HPC deployment. It is working towards an observation and measurement approach to metadata, analysis and production pipeline provenance, UI Reference Implementation, and Apache v2 license.

Simon defined the term “Analysis Ready Data” (ARD): ARD is satellite data that have been processed and organized so users are not required to invest time and resources in specialized skills to apply corrections for instrument calibration (gains, offsets), geolocation (spatial alignment), and radiometry (solar illumination, incidence angle, topography, atmospheric interference). In addition, ARD products are organized in a defined structure with associated metadata, quality flags and products.

Key questions for ARD are where is the processing best performed, how does it vary for different satellite and sensor types, and what limitations result from making choices too early.

A Discrete Global Grid Systems **(**DGGS) is a spatial reference system that uses a hierarchical tessellation of cells to partition and address the globe. DGGS are characterized by the properties of their cell structure, geo-encoding, quantization strategy and associated mathematical algorithm.

Future work that may involve WGISS includes AWS-S3 object storage study, analysis-ready data as an input to data cubes, discrete global Grid systems, adding new datasets (Sentinel-2, SPOT 5/6 prototype processing hub to ARD), and perhaps a link to CWIC.

Robert added that modestly sized data cubes have exorbitant storage costs, so the AWS-S3 study is important to resolve this issue; the principal objective is to lower the cost. He added that on the wiki they created a spot for discussion on the analysis; WGISS participants are invited to register to join the conversation.

## Global Spatial Data Infrastructure (GSDI) Association [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_10.45_GSDI_Agency_Report.pptx)]

Gabor Remetey gave an update on selected activities of GSDI since WGISS-39. He reported that President David Coleman will be presenting the workshop ‘Enabling the Next Generation of Spatial Data Infrastructures: New Technologies and Concerns’ at the DE Summit in Halifax. He will also sign a Memorandum of Understanding with the International Society for Digital Earth (ISDE) represented by President Prof. Guo Huadong. David Coleman presented to the National Geospatial Intelligence Agency (NGA) in Washington DC in September. Sec. Gen. Roger Longhorn is working with the Marine SDI WG of the International Hydrographic Organisation (IHO), focusing currently on European developments, after holding the Marine SDI Best Practice workshop in Cape Town earlier this year. Finally, GSDI is leading a workshop in Nepal in November, and has delegated two of its members to the GEO XII Plenary.

Gabor noted that GSDI has a high level of cooperation with learned societies in the geospatial world, and listed a few of them, as well as a number of websites to access publications and knowledge networks.

GSDI regional-level member activities include preparation of Policy Position Papers, attendance at the Eye on Earth Summit, the EcoCity World Summit, and the IRLOGI annual GIS conference in Ireland with a workshop on ‘Looking into the future from global, European and local Irish perspectives’.

 At the national-level, HUNAGI has joined ESA, providing a challenge and opportunity for the SMEs. He listed examples, such as the Micro Enterprise for awareness raising and community building, an early evolution of a pilot proposal for ESA Danube Data Cube, and the Danube Region Strategy. The DRDSI platform is in development, which will give access to over 1700 datasets in the Danube region.

Gabor concluded stating that interoperable spatial data infrastructures and related services are enabling tools for EO applications. GSDI and its regional and country level members are playing an active role not only serving and supporting EO applications, but also providing awareness raising and generating user feedback. Non-governmental SDIs, open source, open data initiatives, UAVs, IoTs and indoor positioning open new vistas for innovative solutions. The Danube Region Data Service Infrastructure project offers excellent opportunities to launch an ESA-supported pilot with the aim of the establishment of a Danube Data Cube using WGISS experiences in a cross-border environment for the benefits of decision makers in some selected strategic areas.

Wyn asked if they have much interaction with GEO. Gabor replied that they have not in the past, but at GEO XII hope to begin the evolution.

## Centre National d’Etudes Spatiales (CNES)

Richard Moreno reported for CNES that they will launch a study/prototype of the data cube, and have engaged some contractors to work on this. They are using the DC in conjunction with Spark technology, and it is working well.

## Russian Federal Space Agency (Roscosmos) [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_10.45_Roscosmos_Agency_Report.pptx)]

Tamara Ganina gave a report of Russian EO missions of the Russian Space Agency (Roscosmos). Currently the Russian EO satellite constellation consists of seven active satellites. Tamara showed a table of details of these missions, with highlights in red for the data that is/will be freely available. She also gave detailed descriptions of these:

RESURS-DK, for near real-time acquisition of highly informative data in visible and near-IR spectral range for ecological monitoring, natural resources inventory, mineral exploration, and mapping.

RESURS-P, for near real-time acquisition of highly informative data in visible and near-IR spectral range for ecological monitoring, natural resources inventory, mineral exploration, and mapping. Two have been launched, with a third planned for the end of this year. Tamara listed the onboard instruments/sensors.

KANOPUS-V, for near real-time acquisition of highly informative data in visible and near-IR spectral range for ecological monitoring, natural resources inventory, mineral exploration, and topographic mapping. Launched in 2012; next launch early 2016.

METEOR-M, operational acquisition of cloudiness and the Earth’s underlying surface data, meteorological data acquisition, heliogeophysical measurements, Earth’s resources study, and ecological monitoring. Two have been launched, the third is planned.

ELECTO-L, for operational acquisition of cloudiness and the Earth’s underlying surface data, meteorological data acquisition, heliogeophysical measurements.

Tamara displayed a diagram of the technological scheme of the Russian operator’s cycle, and listed a number of EO data receiving stations. She also noted a new launch pad near Vladivostok. A diagram of the geoinformation services operation lists the unified bank of geodata and of EO data products, and the open data portal.

Tamara displayed a diagram of basic products bank (BBP) distribution components. She discussed the interface features of the BBP web service. She also showed several examples of the data search and ordering service, and the interconnectivity of the BBP and the ROSCOSMOS Geoportal, and the future mission launch plans. Tamara stated that the BBP uses OpenSearch, and is using some of the CEOS BP, and working toward full use.

Satoko commented that at WGISS-38 there was mention of data policy changes, based on the resolution of the data. Tamara replied that they hope that at the end of 2015 it will be accessible. She added that there is a new law that all data from 1 meter resolution is open, but not free. The threshold for free mid-resolution is 60 meters.

## Canada Centre for Mapping and Earth Observation (CCMEO) [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_10.45_CCMEO_Agency_Report.pptx)]

Brian McLeod gave a report of the CCMEO’s Earth Observation program. CCMEO plays a leadership role in Canada by providing access to Earth Observation data through satellite station infrastructure long term archiving, and dissemination of satellite imagery for the Government of Canada. The Centre’s remote sensing activities are regulated by the Remote Sensing Space System Act. Their ground stations provide coverage for Canada, Alaska, and the Arctic Circle; three NRCan/CCMEO satellite station facilities provide this coverage.

In 2012 funding was secured to equip their satellite station facilities with state-of-the-art antennas. The funding also supports the data management system to house and safeguard satellite information. The Inuvik satellite station (inside the polar circle) facility is now a modern facility, hosting three antennas, and is established as a unique partnership model that serves as an enabler to access EO data for public good, while commercial opportunities are pursued and local capacity building is enabled.

Brian added that CCMEO is in the process of establishing a collaborative hub for Sentinel-1 data over Canada. A testbed is currently in place and improvements to current limitations on wide-area network latency are expected in the near term.

Jono asked if the Inuvik station is far enough north to provide TT&C; Brian replied that yes CCMEO is currently prototyping TT&C and will provide an operational capability in spring 2016. Jono suggested CCMEO was competing with the Norwegians.

## US Geological Survey (USGS) [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20151001_Thursday/10.01_13.30_USGS_CWIC.pptx)]

Kristi Kline discussed the EROS Land-Change Mapping System (LCMAP), which is a concept for a center-level system that exploits the Landsat archive, and is the next evolution for data. LCMAP is dependent on Analysis Ready Data (ARD); key attributes of ARD are surface reflectance and brightness temperature, QA bands with attributes for zero-fill, clouds, cloud shadow, cirrus (OLI only), snow/ice, terrain occlusion (OLI only), and radiometric saturation, Albers Equal Area projection for conterminous U.S., Alaska, and Hawaii. The ARD will be managed as tiles, not scenes, the dimensions of which are to be decided; the date range extends back to 1982 (Landsat 4 TM) through present (Landsat 8 OLI); “core’ temporal coverage is 1985 – 2015. Kristi displayed a notional data flow for LCMAP ARD, highlighting what is currently provided, what needs to be added for ARD, and what is needed for the DC.

Continuous monitoring requires a collection of algorithms to identify types and timing of abrupt and gradual change on a per-pixel basis. Kristi illustrated this in a graph of the spectral history of a pixel - showing the change over time when a fire and subsequent recovery occurred. The ultimate goal is to make it easier to know what is going on with the landscape.

The next step is to flag pixels identified as exhibiting (gradual or abrupt) change; this requires continuous monitoring.

The final step is take the information and make an assessment; this can be assisted by producing cyclical and special-topic assessments of land change, and communicate this to the stakeholders. How to display that system in a web-based approach is being considered. USGS is trying to change how they show the data – i.e. set aside in a different place the highest quality data (geometrically, radiometrically) so that the user can go get that directly.

Kristi commented that Data Cubes are not really new, it is how they are being applied that is new. They are more lire like a hypercube – 3D plus time plus band. Delivering the data as a DC does not solve some of the delivery problems, because it is still a big group of data.

In response to a question from Wyn, Kristi said they would do all the corrections at the scene level, and then tile it. Richard remarked that at CNES they are looking at what the Postgres database offers for raster projection.

# EO Ground Segment and Data Access Evolution Workshop

Wyn Cudlip and Mirko Albani chaired a workshop on EO ground segment and data access evolution, with participation from several agencies.

### ESA EO Missions [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_ESA_Missions.pptx)]

On behalf of Pascal Gilles, Mirko gave an overview of satellites, ground segment and data access evolution of ESA EO missions. ESA EO programmes are organized in three different pillars: meteorological, Copernicus, and Earth Observation Envelope Programme (EOEP). In addition, there is data from non-ESA missions. He focused on the Earth Explorers, and gave details of GOCE, SMOS, CryoSat, Swarm, ADM-Aeolus, EarthCARE, and the upcoming BIOMASS. He also described candidate future missions and heritage missions, including Envisat, which was operational for 10 years. ESA is working to make the heritage data available, and also to make long-time data series from the data.

Mirko described the EO ground segment functions, which include mission management, satellite control, payload operations, data acquisition, data processing and archiving, and data dissemination. ESA ESRIN is the Control Centre for Distributed Facilities. Data dissemination and exploitation include data visualization and manipulation tools, service support environment, and Grid processing on demand. He also described the EO data archives network in Europe.

EO ground segment evolution consists of a future scenario of interconnected EO platforms, considering how EO data will be used in 2020, and how ESA can prepare for this evolution. Mirko displayed a diagram of interconnected exploitation platforms. In this architecture, the data is on the left, and on the right are the user communities that are evolving in the requirements. What is changing is a network of exploitation platforms that will bring the user to the data. The objectives of the network concept are enabling large scale exploitation of EO data, stimulating the innovation with EO data, maximizing impact of European EO assets and preserving European independence. An exploitation platform is an innovative operations concept: users access a work environment containing the data and resources required, as opposed to downloading and replicating the data locally. Moving user activities to the data means putting together software, ICT resources, and EO and in-situ data.

There are different types of exploitation platforms. One example at ESA is the Thematic Exploitation Platforms (TEPs). Other examples are regional, mission/sensor, and technological platforms. In response to a question from Jono, Mirko stated that there will be a link between the platforms, meaning a network of platforms, and linking with large science networks and ecosystems.

Mirko describe the ESA EO ground segment evolution strategy; the reasons for change include industry and technology trends, mission profile changes, and data management changes, and the objectives. The main interfaces are user services, data access, data reprocessing, data improvement, datasets preservation, and systematic generation. He displayed a diagram of the DGS Operations concept functional elements.

The future approach at ESA is to preserve ESA EO Heritage mission data and knowledge ensuring authenticity and understandability in the long term, with the assumption that one can never anticipate the exploitation value of the data asset in the future. ESA will plan and implement preservation activities in all EO mission phases to capture knowledge at EO data set generation, and establish a coordinated and harmonised approach across ESA and in cooperation with EO data owners in the MSs, to preserve European Space Science data. ESA will also prevent loss of non-ESA EO data that is judged of European long-term interest.

Future approach in terms of curation and valorization is to ensure the full content of the ESA EO heritage archives is maintained discoverable, accessible and usable in the long term through state of art technologies and innovative tools and services. To valorize ESA EO Heritage Data, it is necessary to ensure the full content of the ESA EO archives is fit for contemporary purpose thus enabling multi-disciplinary applications and broader data use, improve data quality through algorithms evolution, data reprocessing, data validation and traceability (QA4EO), build long-time series of coherent data and data collections for specific applications. Generating fundamental Earth Observation data records is based on the combination of archived data assets (heritage and current) from MSs National and ESA EO missions for land, marine, atmosphere, solid Earth and also climate research, to better address high priority societal challenges in Europe.

The way forward for ESA is long-term data preservation and the mission-to-heritage data programme. Two main blocks of activities are planned; the first is preservation, securing, and preventing data loss. The second is mission heritage data, ensuring accessibility, continuous quality improvement, and management of level-1 data.

### Copernicus Space and Service Component [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_Copernicus_Space_Component_Overview_Data_Access.pptx)]

Pierre Potin gave a presentation of the Copernicus Programme. This programme is the European response to global needs to manage the environment, to mitigate the effect of climate change, and to ensure civil security. He listed 21st century societal challenges and the six Sentinels. Pierre explained that Copernicus is a European space flagship programme led by the European Union; ESA coordinates the space component. Copernicus provides the necessary data for operational monitoring of the environment and for civil security and has a free and open data policy.

Pierre showed a milestone chart of the services deployment between 2014 and 2020, showing the six Sentinels and the contributing missions. The Copernicus Space Component Data Access (CSCDA) System manages the coordinated production of datasets: multi-mission coherent data collections pre-defined according to specific user needs in terms of data type and mode of operation. The key component of the CSCDA is the Coordinated Data Access System (CDS), ensuring dataset construction and dissemination by coordinating the Copernicus Contributing Missions production and dissemination flow. Pierre described the CSC operations status, giving product accessibility milestones, and status of Sentinel-1, -2.

The main objectives of the Sentinel operations strategy is reliable provision of data to Copernicus users, and ensuring systematic and routine operational activities. Pierre presented the Copernicus data policy, and gave an overview of Sentinel data access, describing the open data access hub. He also displayed Sentinels data access statistics, with more than 2 million products downloaded by users, representing 2.5 Petabytes of data.

Pierre explained that CSC data access is a continuous evolution, and is based on three main pillars: latest data availability, access to long term archives, and reduced download needs (bring the users to the data). This requires a continuous evolution to adapt to evolving user scenario and needs, introduce latest IT technologies, and implement a continuous performance improvement process.

Upcoming near-term CSC data access enhancements include a benchmark test for online access to African users in the context of GMES for Africa, integration of Sentinel-2 data flow, enhanced connectivity to GEANT network via dedicated 10 Gbps line, and integration of Sentinel-3 and Sentinel-5p. The long termCSC data access enhancements include integration of hosted processing capabilities, roll-out of research and support services, and Federated User Management pilots.

### Sentinel Data Access Service at the Satellite Applications Catapult [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_CEMS_Sentinel.pptx)]

Richard Hilton gave a presentation on the Sentinel Data Access Service (SEDAS). He noted that the ESA-UKSA collaboration agreement enables UK collaborative GS data access. The Catapult is responsible for user management including user registration, license issues, etc. They anticipate three uses cases for access: short-term rolling archive, via spatial/temporal searches, or access for large volume remote processing. He described the baseline and evolved systems.

SEDAS will include forums, news stories, documents, ways to access the data and the products view a view to explore, examine, engage – making it a lot easier for the user. Development planning is underway.

An example use case is maritime situational awareness, a project to help stop illegal fishing. The trial is in the canal islands in the Pacific, looking for ships that are not broadcasting. The next step is to see how it can be scaled.

Academic user access is via JASMIN-CEMS and CEDA, and the user community is primarily in UK universities; it contains a Big Data infrastructure for storage and computing.

### COSMO-SkyMed Ground Segment [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_Cosmo_Ground_Segment.pptx)]

Richard Lowe introduced the COSMO-SkyMed ground segment. He began with background of Telespazio VEGA which is a space systems company.

The UK COSMO-SkyMed Ground Station. The UK’s first Customer User Terminal (CUT) for COSMO-SkyMed. It is a UK-Italian space agency bilateral collaboration for near-real time data and services to UK, providing services to wide range of government and commercial sectors. Examples are flood mapping, oil spill detection, vessel detection, extreme weather event impact assessment, unique near-real time coverage of transatlantic shipping routes. COSMO-SkyMed is based on the concept that radar satellites can image in all weather, day and night, and a unique four-satellite constellation provides unparalleled revisit frequency and coverage. UK CUT is a successful collaboration built on existing infrastructure (assets) and COTS systems.

Richard displayed a diagram of the GEOStation production workflow, and an image of overlays including the radar data, showing flooding.

Emerging ground segments include CUBESATs which are fast expanding area that is served poorly by existing ground segment infrastructure, and also include collaborative ground station networks in a much larger scale than existing networks. In an effort to develop fully integrated EO capability, data quality and accessibility must be ensured and must be tailored to user communities and their needs. The user community is growing at Harwell.

### GA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_GA_EO_Ground_Segments.pptx)]

Simon Oliver discussed EO ground segment and data access evolution from the point of view of the Alice Springs Refurbishment Program. This data acquisition facility in centrally located in Australia, and is being driven to modernize due to significant reductions in operational staff leading to a reduction in reliability. Improvements in the communications link between Alice Springs and Symonston has occurred and Australia has received a request from the USA to take a formal role in the management of Landsat 8. This will require processing of all ‘live’ satellite data; at the moment half the live Landsat 8 data is being discarded.

Simon gave an overview of the site, and described the upgrade philosophy, which is primarily to increase reliability while decreasing complexity, increasing flexibility, and using industry-standard approaches to hardware. He summarized the tasks that have already been completed.

### CNES [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_CNES_PEPS.pdf)]

Jérôme Gasperi described the Platform for the Exploitation of Sentinel Products (PEPS). The PEPS platform is the French collaborative ground segment for Sentinel data. It will store and provide access to all Sentinel 1-2-3 products. By 2017 there will be 7 PB. Currently they have 7PB on tapes, with 2 PB on hard drive with automatic migration based on rules, and seamless retrieve.

During the ingestion process, each product metadata is semantically enhanced using iTag Web Service. They are able to stack layers of data providing coastline, topography, population density, land-cover, etc. Ingestion is a one-line REST POST request, and PEPS distribution is based on RESTo. RESTo is an Earth Observation search engine compliant with OGC/WGISS EO OpenSearch standard.

QueryAnalyzer is a standalone Web Service that can ingest 12,000,000 Sentinel simulated granules in 0.4 seconds. Search time for the user is between 0.2 and 0.6 seconds depending on the number of concurrent users. Jérôme also described the download process.

Jérôme recommended different processing for two kinds of users: developers and normal users. Developers have access to a UNIX account, read-access to the data, can deploy their processes, can launch massive processing, and can bind their process to WPS. Normal users know nothing of VMs, have read-access to data from an HTML client or a web service, and can launch pre-existing processes provided by the platform either from the HTML client or the WPS endpoints.

PEPS will integrate multiple ESA initiatives such as Coastal TEP, SparkInData, etc. PEPS will focus on pragmatic interoperability. Major functionalities are built as standalone Web Services so they can be used in/by other projects (e.g. iTag, QueryAnalyzer). PEPS uses simple REST Web Service and JSON for Web Services (e.g. search service provides ATOM output only for standard conformity but GeoJSON output is the default). The next step would be to move to (Geo) JSON-LD (i.e. linked data) and to standardize JSON output in OpenSearch.

Richard has commented that the system has been operational since July.

### NASA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_NASA_Sentinel_Gateway_Status.pptx)]

Dawn Lowe described the NASA Sentinel Gateway for facilitating EOSDIS mirroring of Sentinel data. She listed the current capabilities and described the planned NASA Sentinel Gateway capabilities. These will serve as a single interface between the ESA International Data Hub and multiple NASA DAACs to minimize bandwidth on European networks. It will be initially sized for Sentinel-1A and Sentinel-1B Level 0, Sentinel-3A, Sentinel-3B and Sentinel-5P for Level 1B. The gateway will provide access of Sentinel products to multiple DAACs, operator tools for monitoring the Gateway’s health and status, and provide on-line data access for bulk data downloads by other US Government Agencies.

Currently the Gateway provides the capability to ingest and verify products downloaded from the ESA Scientific Data Hub, and to verify checksum of SAFE files and manifest files. It also provides data to ASF using the polling with Product Delivery Record (PDR) mechanism and GridFTP-Lite, and is capable of handling ingest, storage, and distribution of data from multiple missions. It also can detect missing data products and request retransmissions from the Scientific Data Hub, and provide a configurable 32-day (TBD) rolling buffer.

### USGS [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_USGS_Sentinel.pptx)]

Kristi Kline gave a presentation on the USGS plans for archive and distribution of Sentinel-2 Multispectral Imager (MSI) data. She began with general background and the science rationale, since combining Sentinel-2 and Landsat-8 data streams offers near-daily, global 30m coverage. Revisit performance is much improved when adding Sentinel to Landsat, and she displayed the results of the revisit performance analysis.

Kristi described what is needed to make full use of Sentinel-2 data: User access to S2 L1C Data (USGS) and MSI Characterization and cross-calibration with Landsat-8 (NASA, USGS); higher-level products (NASA) such as sensor reflectance products, merged Landsat + S2 reflectance product and higher-level land cover and biophysical products. Sentinel-2 data would be made available under the same policy as Landsat and the levels of service to be provided must balance user needs and available budget.

Kristi described three tiers of level of service:

* Tier 1: The minimum requirement to be met to ensure that users can discover, access, and retrieve the Sentinel-2 data.
* Tier 2: An intermediate requirement level between threshold and target which, if achieved, would result in substantial improvement in the accessibility and usability of the Sentinel-2 data; this builds upon Tier 1 Levels of Service
* Tier 3: Expanded processing capabilities for full radiometric and geometric characterization, calibration, and product generation.

Regarding the tier 1 scenario, Jono asked if USGS is planning on capping the retrieval. Kristi replied that services will be the same as what is given for Landsat, which means bulk download and machine-to-machine gateway. Methods to prevent overload of the system from one single user will be implemented.

### DLR [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_13.30_DLR_SatellitesGroundSegmentAndDataAccessEvolution.pptx)]

Katrin Molch gave a presentation on satellites, ground segment, and data access evolution at DLR. She began with a brief description of the TerraSAR-X, TanDEM-X, EnMAP and Tandem-L missions. She also described the DLR ground segment and system landscape: archiving and access, processing, decision support. Data management is done by the Multi-Mission Data and Information Management System (DIMS) developed in-house in collaboration with an industrial partner. DLR has provided a few community portals for access to their data, and their EO web portal is the workhorse portal. EO missions supported by DLR (multi-mission payload data ground segment) include national missions, ESA/EU missions, and scientific and commercial partner missions.

D-SDA data volume and user access is growing exponentially, with an increasing demand for fast delivery of data and products. To handle this, DLR has developed the Geospatial Data Access System (GDAS), allowing for direct download instead of ordering.

The evolution of the German Satellite Data Archive - “D-SDA 3.0” - is aiming at ensuring long-term data preservation and need to find a sustainable way to fund the data preservation. National public entities shall gain access to EO data through the National Remote Sensing Data Service, Moreover the evolution includes Big Data concepts for Copernicus, improved data discovery and access, D-SDA application services, and data stewardship.

DLR has a role in Copernicus Sentinel Ground Segment, including Sentinel-1 PAC and long-term archive and Sentinel-3 OLCI PAC and long-term archive, Sentinel-5 Precursor PDGS, and one of the Data Hub Relays. DLR also is participating in several German national initiatives, and a project connecting the Copernicus space component to the service sector. This could be a prototype for a national mirror site.

# WGISS Interest Groups

## Data Stewardship Interest Group

Mirko Albani chaired the Data Stewardship Interest Group session.

### Overview, Updates and Status of CEOS Best Practice [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_DSIG_Overview_Updates_CEOS_Best_Practices_Status.pptx)]

Mirko Albani began with an overview of the DSIG, with updates and status of the CEOS Best Practice. He began with the feedback form they have received from the GEO Data Management Principles Task Force (DMP-TF). This can be summarized with the statement: The value of each EO is maximized through data life-cycle management, including five foundational elements: discoverability, accessibility, usability, preservation, and curation.

Mirko listed the DMP-TF current tasks and next steps. These center around the *DMP Implementation Guidelines* document, which will be presented at GEO-XII, and updated for acceptance at GEO-XIII. In addition, they plan to develop metrics for monitoring the GEO community implementation of the DMP Implementation Guidelines. GEO will also transition the DMP Task Force to a standing WG in 2016 whose mandate includes support for Guidelines Implementation in the GEO community.

Mirko announced several conferences of interest, including the PV 2015 Conference on Ensuring Long-term Data Preservation, and Adding Value to Scientific and Technical Data, November 3-5. He noted that it is important to know what other agencies are doing in the area of data preservation, and participation from WGISS is encouraged. Other conferences are the Big Data from Space, 2016 (which conflicts with WGISS-41), and The Living Planet Symposium 2016 which is focused on users exploiting observation data. There will be an LTDP session, and Mirko invited all to present a paper.

Mirko explained the document drafting and approval cycle and also gave details of the Persistent Identifiers (PI) Best Practice. This document has been submitted, but there are still some issues to discuss around whether PIDs should be assigned to near-real time (NRT) products. The question arises as to whether a specific PID is different from the one assigned to archived time series products. If it is not going to be permanently archived, then it does not need a PID. One option is to assign a NRT DOI to the equivalent where they can use to reference their work.

Andy commented that there can be a DOI for each NRT if on the landing page there is a pointer to the DOI of the science product.

**Action WGISS-40-07**: Mirko Albani to distribute a proposal for NRT DOI, and distribute for comment on what the agencies are doing.

Mirko displayed a Data Stewardship Best Practice document tree. Completed documents are:

* Preservation Workflow
* Persistent Identifiers Best Practice
* EO Data Set Consolidation Process

The following documents are ready for approval; the first two were accepted by WGISS as best practice.

* EO Data Preservation Guidelines
* Preserved Data Set Content
* EO Data Stewardship Glossary

The Glossary has been circulated, but there needs to be WGISS discussion about the future of this document.

Finally, Mirko presented four bullet points for the Purge Alert Procedure, and also a decision chart. He listed CEOS involvement and open points. This will be presented at the next CEOS-SEC teleconference. Richard suggested that two high level slides be prepared for the CEOS Plenary audience.

**Action WGISS-40-08**: Mirko Albani to consolidate the data purge alert procedure for the CEOS Plenary.

### Preservation of Software and Documents

Mirko introduced a session on preservation of software and documents at CEOS agencies and in other domains.

The key issue is to recommend the formats (see below) that would be most convenient for preserving text documents, metadata files, and videos, and to draft a Best Practice on recommended approaches for information and software tools preservation based on CEOS agency experience.

* Text Documents (word, txt, ppt) 🡪 PDF, PDF/A, FITS, other;
* Images (bmp, tif, jpg, gif) 🡪 TIFF, FITS, other;
* Metadata file 🡪 XML, ASCII;
* Video (*avi, vob, m4v, mov, mpx, etc.)* 🡪 MJ2, other.

#### CEOS Agencies [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_Preservation_Software_Documents_CEOS_Agencies.pptx)]

Iolanda Maggio gave a presentation of approaches and lessons learned of preservation of software and documents from a CEOS agency perspective. She began with definitions of preservation and digital objects, and listed associated knowledge elements. She explained the formats that can be used for text documents, images, metadata, and multimedia. She also listed the software preservation techniques that are available: preservation, virtualization, emulation, migration, cultivation, hibernation, deprecation, and procrastination.

Iolanda described approaches and lessons learned in other domains, including the Vatican Library, the International Cartographic Association, the Planetary Data System, the US National Archives, Smithsonian Institution Archives, Science and Technology Facilities Council, Interuniversity Consortium for Political and Social Research, and the CCSDS. She also gave detailed information on the Planetary Data System.

Iolanda concluded that there is no defined best practice on software and document preservation in the space domain. There are also few recommendations on document format in the library domain and few references on software preservation.

#### FITS Standard [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_FITS_Standard_Vatican.pdf)]

Luciano Ammenti, Vatican ICT Services, gave a presentation on the Vatican Library long term digital conservation for manuscript collections. He gave background on the Vatican Library, and described the library mission, which for last 500 years has fulfilled the fundamental role of preserving, protecting and restoring the patrimony of books kept there. The library started a project of "long-term digital preservation" that on one hand gives all possible guarantees of longevity of the realized technological product and on the other would allow the disclosure of the manuscripts possessed by the Vatican Library to a wide representation of users worldwide.

Luciano emphasized the need to digitize, but selecting the format is important, and he compared TIFF to FITS formats. Conservation should be in an open source format. He added that the procedure for the scanning is very delicate and calibration standards must be followed.

A software-defined approach grants the ability to handle this kind of heritage in a very simple and secure way, and means that their IT infrastructure needs to be agile and innovative. Distribution is the last significant step. A sophisticated catalogue is required because the manuscripts can be very complex to categorize (title, author, attribution, version, etc.) He concluding saying that people and high technology is the secret mix to be innovative.

Yonsook asked if the six month update is always backwards compatible. He said yes, and he can confirm that from his experience.

#### ESA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_CEOS_Agencies_Approaches_Lessons_Learned.pptx)]

Mirko Albani presented the ESA approach to information and software tools preservation. He began with a description of the preservation life cycle: A loop ending in determining lessons learned after the implementation, and applying them for the next round.

Two categories of documents are to be preserved: Mission documentation (mandatory) for which two preservation formats are considered for implementation (PDF/A, FITS); and other documentation (e.g. papers, presentations) for which one preservation file format is considered sufficient (PDF/A). Currently many documents exist on paper only, and in several other formats.

There are also images related to EO missions; preservation format considered is TIFF or FITS depending on the complexity level of the metadata schema to be preserved. The selected preservation format is XML for metadata files, and multimedia file format selection is under analysis.

During the initial dataset appraisal a decision is made on the approach to be followed to handle and preserve the mission data and the related software. The software preservation approach can be based on different strategies for different missions (e.g. virtualization, periodic migrations, hibernation). Mirko presented experiences with virtualization, and examples of preserved missions (SEASAT and JERS-1).

In response to a question from Andy on the virtualized processing, Mirko said that once the processing is completed it is put in the dissemination system, which is a cloud environment.

#### GA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00%20_Geoscience_Australia_Collection_Management.pptx)]

Simon Oliver discussed collection management at GA. Previously, collections were an evolution, with none or minimal provenance, no version control and no updating of ancillary inputs. Simon displayed a diagram of the AGDC production workflow from raw data to data cube tiles. The process should support starting with acquisition first file write at the ground station (antenna, channel, demodulator used, demodulator software and configuration file version, and data quality).

Elements of the solution towards repeatable pipeline production processes include system snapshot as part of production rollout, version control of everything (software and data), automated retrieval of ancillaries and update, provenance reporting for process based on version controlled inputs and outputs, provenance analysis, workflows for automation, patch and reprocess with workflow. All of this should be related to business managers – iterations cost, cumulative issues and thresholds, expert advice.

Version controlled system snapshot can enable reproduction of a processing event when the system that created an output and the output itself no longer exist. Options are to capture the entire processing environment on release to production, or to capture the construction process and the dependencies for creation.

Simon described the tool PROMS, which is a restful web service responding the HTTP POST and GET requests. Provenance traces can be found by querying the various query endpoints of PROMS. These endpoints are database command line interface, RESTful API, and relevant for provenance traces expressed in an RDF ontology such as PML-P or PROV-O. For reporting provenance, Sumatra API is a tool for managing and tracking projects based on numerical simulation and/or analysis, with the aim of supporting reproducible research.

Managing collections through provenance means working toward a self-healing collection using Luigi from Spotify.

Incorporating workflow, provenance, version control in all code, version control everything, enabling PROMS-O compliant reporting, formulating scripts to analyze provenance, and deciding on the level of granularity for provenance capture are challenges to making all this part of the business process.

In production refactor - workflow components have been broken down to enable fine-scale provenance capture. Desired granularity of provenance may be abstracted from this. Potential tools have been identified.

Kristi asked him to discuss what would constitute reprocessing the data. Simon replied that the idea of the business engagement is to make the determination of images that can be fixed – should they be versioned, or wait until a reprocess occurs. It comes down to need and relevance. The newer missions tend to need reprocessing, so the question is, should the entire collection be reprocessed, or just the sub-components. There is a lot to consider and managers need to look at the complete picture to come to a decision.

#### CNES [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_CNES_Data_Preservation_approach.pptx)]

Benoît Chausserie-Laprée began with a discussion of main steps of data management: production (acquisition, processing, storage, and access), preservation (transfer, maintenance, and access), and destruction or transfer to another organism.

Benoît explained the methodology steps during the development and operation phase, and then the operation phase in order to prepare the service removal phase. He displayed a table that summarizes the phase. The archiving plan content includes a purpose, legal and contractual aspects, data (identification of the activities to be carried out), tools to be developed, risks and constraints, and planning.

He displayed a diagram of the CNES SERAD operational procedure for the space data preservation.

Benoit explained the CNES rules for documentation preservation using MS Word, Acrobat PDF, XML, and the dedicated document configuration management tool that they use. For software preservation, he explained the CNES approach and tools used. He noted that after the service removal phase the software is not preserved. He also showed examples of preserved document catalogs and access in the CNES archives, alongside the data and the data search.

In response to a question from Mirko, Benoît said that they only provide the source code. If the user wants to compile it, it will take some installation.

#### CCMEO [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_CCMEO_Data_Stewardship_Rrepatriation.ppt)]

Brian McLeod gave a presentation on RADARSAT-1 Foreign Data Repatriation. RADARSAT-1 data is archived where received, at 51 ground stations. In September 2010, CSA released the R1 Foreign Data Consolidation Plan (needs updates), and in January 5, 2015, CCMEO and CSA met and agreed on some principles regarding R1 Foreign Data Repatriation.

Brian noted that the key challenge lies in foreseeing the needs of the user community and future uses of R1 foreign data archives; the Government of Canada SAR Application Working Group will define the designated community (DC), in consultation with DC (CDC) by CCRS:

CDC AI-1 – identify GoC users of R1 foreign data (complete);

CDC AI-2 – DC specification of preservation requirements;

CDC AI-3 – Cost Model update by CCMEO;

CDC AI-4 – Inform/Confirm with DC.

Appraisal is based on merit criteria advised by science, risk and cost trade-offs; dataset appraisal includes:

DSA AI-1 – stewardship, access and distribution;

DSA AI-2 – update to AD B (a CSA document);

DSA AI-3 – visualization tool implementation plan (complete).

Brian described the steps for access to R1 data, from discovery to retrieval, and displayed the planned schedule for the next three years. CCMEO’s methodology is in accord with CEOS best practices.

#### JAXA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_JAXA_Software_Preservation.pptx)]

Satoko Miura gave a presentation of the JAXA approach to software preservation. She began with a list of the data processing software for EO satellites. Satoko mentioned that the possible approaches for JAXA are preservation of hardware, virtualization, migration, and procrastination, and listed the issues associated with each of these. The preservation flow begins with the contract completion. If extended support is available, the contract is extended and hardware is preserved (procrastination). If not, system replacement follows (virtualization, migration).

Satoko gave examples of TRMM/PR, ALOS, and GOSAT, where software was/will be migrated with its follow-on mission. A second example is MOS, JERS-1, and ADEOS (1/3), where data policy changes have occurred, as well as system concept changes. In this case, all the processed data will be available to users, but if additional processing is required, it will be very rare.

#### NASA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_NASA_ESDIS_Preservation_Activities_Sofware_Documentation.pptx)]

H. K. Ramapriyan gave a presentation on software and document preservation activities at NASA. He explained that preservation involves the protection of bits, discoverability and accessibility, readability, understandability, usability, and reproducibility of results. The NASA Preservation Content Specification (PCS) has been in effect since 2011 and covers eight categories of content. The eight categories covering pre-operations, data calibration, science data products, documentation, software, algorithm input, and validation, and software tools. The process is complicated by the diverse number or organizations holding relevant content during the project life cycle.

The Distributed Active Archive Centres (DAACs) follow the procedures, and new missions are required to plan to preserve and deliver to DAACs items listed in PCS. The PCS is also being used as a checklist in gathering preservation content from older missions that have been completed. Missions are also required deliver product generation software (source code). The purpose of preservation of software is primarily for users to understand exactly how products were generated. It is not expected that “heritage software” will necessarily be executable in a new or future computing environment; it may take significant effort to regenerate products from preserved software. In some cases, software specification documents have been deemed acceptable as substitutes for source code. The PCS also calls for several types of documentation covering project/data life cycles.

NASA would like to see a broad international standard identifying preservation content – NASA’s PCS may be a good starting point. ISO/TC 211 had approved a New Work Item Proposal (NWIP) for ISO 19165 before NASA’s draft for a preservation content standard was generated.Two options are to include content similar to NASA’s PCS as a part of ISO 19165, or to wait for ISO 19165 to be completed and initiate an extension.

There are five working groups at NASA that focus on the data stewardship interest area. These span data preservation practices, data quality, data interoperability, digital object identifiers, and interoperable provenance standards.

Mirko noted that there is quite a lot of overlap with what is being done in WGISS, and it would be very good to move toward the standardization. It would be helpful to add the valuable material that NASA is generating in the documents WGISS is producing. Andy said that they hesitate to submit something before it is matured. Input from an external body would be very valuable. Yonsook asked if the focus of the ISO standard to understand the data or to be able to reprocess it downstream. Rama said ISO 19165 is at a high level as a “framework”, and he is trying to push for a more detailed content standard. It will take a long time for the standards process to be completed, but the agencies can work together to submit proposals.

#### UKSA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_09.00_Satellite_Applications_Catapult.mp4)]

The Satellite Applications Catapult at UKSA submitted a recorded presentation.

### Conclusions

**Action WGISS-40-09**: Mirko Albani to review all the presentations on Document Preservation and present a summary and way forward proposal at WGISS-41.

**Action WGISS-40-10**: Mirko Albani to liaise with H. K. Ramapriyan to see if WGISS can contribute to ISO standard for preserved data content.

## Technology Exploration Interest Group

Andy Mitchell chaired the Technology Exploration Interest Group session.

### Cloud Processing at ESA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_13.30_Cloud_Processing_ESA.pptx)]

Cristiano Lopes gave a presentation on cloud processing at ESA, which has its uses in processing, archiving, distribution, and discovery. He defined cloud services, and discussed the EO data distribution over a content delivery network (CDN). A CDN provides dynamic geographical load balancing; GOCE Gravity field data has been distributed over CDN with good success and ENVISAT and ERS SAR data, also distributed but with low success. CDN has a very high user satisfaction, transparent caching of data at different locations, and peak loads not affecting ESA infrastructure. However, it is also expensive, and only for “stable” and consolidated data.

Cristiano discussed infrastructure and processing of cloud deployment. He also discussed the evolution of managed hosted services, and hosted processing.

Andy asked if he would you say the benefits outweigh the cost. Cristiano replied that for some data, definitely yes; for others, definitely no. Andy also asked if you can reduce the risk of performance effects by paying a higher premium. Cristiano said you can, but the arrangement depends on the provider. Kristi asked if it is costly to change providers; Cristiano said that it can be.

A lesson learned in the area of cloud services/technology is that this is a new solution to old problems. The challenges are technology maturity, ESA Industrial Policy, and security. Opportunities are that it provides a neutral environment with open access to anyone, one place to develop, prototype and run applications; potentially unlimited resources allowing for new ways to exploit EO data (big data); and space to define an EO Cloud Architecture. Cristiano also described the cloud processing framework.

In summary a number of activities related to cloud technology and services have been performed. The Cloud is an enabler that allows ESA to perform is data exploitation activities in a more efficient way. ESA believes there is room for collaboration and cooperation in the use of the Cloud with other partners. One such possibility of collaboration is the definition of standards, best practice and an architecture for EO Data Exploitation. The Cloud Processing Framework is a first example.

### Retirement of FTP

Andy Mitchell introduced the session on agency experiences when retiring FTP for data delivery.

#### NASA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_13.30_NASA_%20FTP_VS_%20HTTPS.pptx)]

Andy Mitchell gave a presentation contrasting FTP and HTTPS for data access at NASA-EOSDIS. Registration is a requirement at EOSDIS for data access. The impact on FTP is different than the impact on HTTP. For FTP there is minimal impact, but there is also no direct support, no secure authentication, and is sometimes prohibited. For HTTP there is comprehensive support, support for many extensions and metrics-gathering, and it is generally permissible.

User registration (URS) is available; a staggered approach will be utilized to implement URS throughout DAACs, subsystems and applications. Schedules and transition plans for implementation will be negotiated between affected systems and ESDIS.

Andy described the Near Real Time Data Access (LANCE) HTTPS file distribution requirements. He also reported that LP DAAC switched from FTP to HTTP for data access on June 4, 2013. This change was advertised on the LP DAAC website as a news item.

Understanding that many users use scripts to get data from anonymous FTP servers, this will require social as well as technical changes. NASA is gathering use cases and lessons learned from other DAACs in addition to providing ‘recipes’, reference software to automate authenticated HTTPS downloads, bulk download web clients, user tutorials and documentation.

Cristiano agreed that the solution is education; Richard added that CNES is no longer using FTP. Satoko noted that even when JAXA changed from FTP to secure FTP they received a lot of complaints.

#### USGS [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_13.30%20USGS%20FTP%20Retirement.pptx)]

Kristi Kline described the retirement of FTP at USGS. She said that with FTP, users requested products from an interface, and an email was sent to the user with instructions for download; authentication only allowed the user into the directory for the product. This is generally referred to as “semi-anonymous FTP”. However, USGS no longer allows the use of FTP for security reasons.

Today, all products are distributed with HTTP using user basic authentication. The data is in the “DMZ” – not behind a web firewall. Users had previously scripted downloads using FTP, but now tools like wget and curl allow scripting for HTTP. No performance issues were noted, and HTTP allows for bulk metadata and bulk download tools. Some web tools like *downloadthemall* are helpful.

Also available is machine-to-machine interface using API and role-based permission in EarthExplorer for large customers.

### Open Source Software Practices at CEOS Agencies

Andy Mitchell introduced the session on agency experiences with releasing software to Open Source.

#### NASA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_13.30_NASA_%20FTP_VS_%20HTTPS.pptx)]

Andy Mitchell submitted a presentation comparing FTP to HTTPS at NASA.

#### NASA World Wind Europa Challenge 2015 [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_13.30_NASAWWEC.pptx)]

Gabor Remetey gave a presentation of Open Source platform for analysis and visualization from the World Wind Europa Challenge perspective. He gave the background on the WWEC, described the evaluation criteria, and gave the milestone roadmap. He also listed the 2015 winners.

NASA World Wind is a sound open source base for development and applications, and has led to commitments for WebWorldWind worldwide, and a wide range of best practice and basic applications.

Gabor concluded that industry and government should be moving ahead with WorldWind since WebWorldWind is a competitive platform for innovative solution.

#### Open Source Practices at ESA [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_13.30_ESA%20Open%20Source%20Practices.pptx)]

Olivier Barois gave a presentation on open source practices at ESA. The objectives are to improve ESA governance on Open Source Software procurement, according to technical needs, covering licensing aspects and the establishment of clear guidelines and procedures for OSS transfer outside the MS. An ESA inter-directorate OSS Taskforce was set up in 2010 and recommended the OSS policy, which was approved in September 2011.

Open source is justified at ESA since space programme OSS can provide cost savings and innovation. Technology programme OSS can result in savings in the domain of software R&D (36% savings estimated in an EU study). For industry it can provide ways to enter the market (in particular for SMEs) and cost reduction for development and maintenance of software products and tools.

The first key point of ESAS’s OSS policy is to authorize the use of Open Source Licensing as legitimate, technically valid and a legally sound options for ESA software developments in the cases of collaboration with universities and research institutes; promotion of space international standards; mission data processing tools; engineering tools; and industrial commercial interest. Other key points are to authorize the use of the ESA Open Source License Agreement for software that are not bound to another Open Source License Agreement, establishment of an ESA’s Software Licensing Board (ESLB), definition of OSS Procurement Guidelines (updates of ESA’s General Clauses and Conditions for ESA Contracts), and implementation and maintenance of an ESA OSS Repository for ESA wide use and support to industry.

Olivier gave additional details on ESAS’s Software Licensing Board, and explained that ESA’s opensource software license can be tailored to the copyleft flavor required by the project (strong, weak or none at all). Strong copyleft: requires anyone who distributes the code or a derivative work to make the source available under the same terms. Similar to GPL. Weak copyleft: lets people do anything they want with the code as long as they provide attribution back to ESA and don’t hold ESA liable. Similar to MIT, LGPL, BSD. None at all: sub-licensing forbidden; ESA retains all rights.

ESA now has a software repository in a community site; it is the ESA equivalent to GitHub.

In line with the spirit of the free and open data policy, ESA’s Earth Observation ground segment department is committed to develop more and more open source software. ESA has set up a solid and wide policy concerning Open Source, and is deploying tools and procedures to support it. Many Open Source software released in the past, and Open Source software contribution will increase in the future.

#### CEOS Data Cube Open Source Software Status [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150930_Wednesday/09.30_13.30_DATACUBE.pptx)]

Brian Killough gave a presentation on the CEOS Data Cube open source software status. He began with a diagram of CEOS Data Cube architecture, and high-level Data Cube requirements, which include free and open access to software and APIs, documented processes for data cube generation, new data ingestion, and application interfaces. Requirements also include cloud-based or local deployment, “Analysis Ready” data products for satellite data layers (fully processed – calibration, geolocation, radiometric), preservation of native data product grid formats, computational flexibility to allow re-projection into “nested grid” formats for multiple dataset interoperability and spatial consistency, reference user interface that supports data cube statistics/analysis and optical image preparation (e.g., mosaics). Finally, the requirements include enabling user development of applications through flexible APIs and architecture flexibility and standards to support Data Cubes for local, regional or country scales.

Brian described the Kenya Project and the Colombia Project.

The NASA-SEO, CSIRO Australia and Geoscience Australia are managing the CEOS Data Cube Open Source Software. This includes background on Australia Geoscience Data Cube, Wiki and GitHub (open source repository). Software is released using the Apache 2.0 license. This is a very permissive license that provides an express grant of patent rights from contributors to users and allows open distribution and commercial use. The NASA internal approval for open source release took 2 months. This includes approvals from software engineering, legal and export control. NASA will release its first version of code within a week, including Landsat “ingestor”, Kenya Data Cube and a reference user interface (mosaic creation).

Brian also listed future plans for the Kenya and Colombia projects.

Cristiano asked for elaboration on analysis-ready data – data that requires minimal processing or has reached a processing level where user does not have to do further processing: calibration, geolocation (basically level 2).

## CEOS Interoperability Interest Group

### CEOS OpenSearch Project

Yoshiyuki Kudo, Jérôme Gasperi chaired the CEOS OpenSearch project session.

#### Project Status [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_09.00_OpenSearch_status.pdf)]

Yoshiyuki Kudo noted that the goal of the project was to establish OpenSearch Best Practice of CEOS catalog systems. The project purpose was to promote the use of the OpenSearch standard as a means of data discovery for Earth Data providers, defining the expectations and requirements of candidate OpenSearch implementations, and removing ambiguity in implementation where possible. Other purposes were to facilitate the aggregation of results between disparate Earth Data providers via OpenSearch common standards, allow for clients to access search engines via an OpenSearch Description Document (OSDD) with no a priori knowledge of the interface, and facilitate smooth integration between related OpenSearch implementations, such as a dataset resource collection that refers to granule resource collections from another provider.

Yoshiyuki gave the historical background and discussed the Best Practice document with 17 Best Practices. Version 1.0 was published May/June 2015.

A Developer Guide was originally written by the NASA team, but WGISS decided at WGISS-39 to convert this into a WGISS OpenSearch Developer Guide. This developer guide and the Best Practice document now have overlaps, and a reorganization or merger of the two documents is recommended.

#### CNES Implementation Status [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_09.00_CNES_OpenSearch_status.pdf)]

Jérôme Gasperi discussed the OpenSearch implementation status at CNES. He began with CNES data availability current status. He stated that PEPS/THEIA are OpenSearch compliant to OpenSearch Best Practice document v1.0.1, except BP001, two-step search.

Jérôme listed the OpenSearch endpoints, and the links for THEIA, Take5, and PEPS.

#### ESA Implementation Status [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_09.00_ESA_Opensearch.ppt)]

Yves Coene discussed the ESA feedback on v1.3 of the Developer’s Guide. Their recommendation is to refactor and not introduce additional requirements in the Developer Guide, referring to the Best Practice requirements when providing guidance, and moving agreed additional requirements to an update of the Best Practice document, e.g.:

CEOS-DG-006 (geo:geometry profiles)

CEOS-DG-014 (preserve all info in URL template)

CEOS-DG-018 (rel=first, previous, next, last, self)

CEOS-DG-021 (dc:date)

CEOS-DG-022 (atom:link types)

#### Future of OpenSearch Project [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_09.00_ESA_Opensearch.ppt)]

Yves Coene made the following recommendations on a future project:

* Update of CEOS OpenSearch Best Practice v1.0.1, with refactoring and finalisation of Developer's Guide, and a conformance test environment - definition of CEOS Conformance Test to verify compliance with respect to CEOS BP of external OpenSearch servers.
* Update of CEOS OpenSearch Best Practice v1.0.1 to clarify/strengthen applicability of OGC specifications (e.g. page 9 "encouraged"). Distinguish between applicable and reference documents. Implementation feedback (clients, servers, tests). Add additional requirements (e.g. from original Developer's Guide)
* Update of CEOS OpenSearch Best Practice v1.0.1, e.g.

BP-004: Unclear what are the conditions a server should comply with, to state that it complies with the CEOS Best Practice v1.0.1 e.g. is compliance with CEOS-BP-009 (which is [optional] and not a [requirement]) required?

BP-011: should be clarified to state that the dc: namespace used in this requirement should correspond to the dc: namespace defined in OGC 10-032r8.

BP-014: Best Practice should provide an encoding example for multi-polygon footprint. Using corresponding GML in georss:where violates the (limited) GML schema referred to from GEORSS Web pages.

BP-016 wording to be updated to clarify that this applies to Granule search responses only.

* Update of Best Practice to:

Define expected behavior of wildcards in search parameters (eo:platform="SPOT\*")

Guidance on returning multiple browse images (multi-polygon).

Guidance for search parameter names:

Guidance for parameter values:

In case of syndication/aggregation, provide provenance information as rel="via" links at feed level in similar way as http://www.openarchives.org/rs/1.0/resourcesync#RePub?

Extend/Clarify Parameter extension 1.0 Draft2

Define priority of <Url> template versus Param extension in case parameter list is different.

Distinguish between exhaustive and non-exhaustive list of <param:Option> elements in <param:Parameter>

Options (for instrument) depending on choice for other parameters (e.g. for platform)

Guidance on how to return multiple files as "rel=enclosure" (e.g. Metalink file as enclosure)

Improve/extend OGC 13-026r5 with (subset of) CEOS Best Practice requirements

Change request to Parameter extension of OpenSearch or update of this specification

#### Discussion

Yoshiyuki said he agreed with Yves’ suggestions for Best Practice. Mirko asked if everyone is in line with the proposal for updating the BP, and finalization of the DG, and also to conformance test environment.

Andy commented that it may not be good to continually update the document, because it will delay the implementation. Yves clarified that it is not really a change, but interoperable and backward-compatible. Satoko wondered if the BP is a living document; for the Project an ending point needs to be reached. Mirko noted that the message is that this update is needed to ensure interoperability.

It was agreed to formally close the CEOS action for the OpenSearch Best Practice. Versions of the BP document can be produced, but should be limited. The Developer’s Guide and the BP documents are clearly two documents. Some BPs in the Dev Guide should be moved to the BP document.

**Action WGISS-40-11**: OpenSearch Activity Team to update the OpenSearch Best Practice Document by WGISS-41.

**Action WGISS-40-12**: WGISS-Exec to determine who will lead and participate in the OpenSearch activity to update the OpenSearch Best Practice Document at the next WGISS-Exec meeting.

### International Directory Network (IDN) Report [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_10.00_IDN_Report.pptx)]

Michael Morahan gave the report on the IDN. He noted that the actions assigned to the IDN from WGISS-39 are both completed. Michael displayed an image of the IDN website executive dashboard, and noted that in all categories the number of visits to the site increased by more than 20% since last year. CSW usage has dropped, and OpenSearch (CWIC) has increased by a corresponding amount.

IDN usage metrics by continent and country was displayed, showing the highest numbers in Asia. The top five countries for usage are United States, India, Republic of Korea, China, and Canada. Michael reported a 27% increase this year in the number of CEOS metadata records, adding that this will continue to increase with known additions from NOAA, ROSCOSMOS, and CNES. He displayed the monthly metadata additions and updates. Michael mentioned the existence of the IDN statistics page.

GCMD keyword releases spanning March 2015-September 2016 were listed. The keyword topics are land surface, atmosphere, ecosystem, terrestrial hydrosphere, water vapor and water quality/chemistry).

The IDN Beta site has new sort options.

There will be no changes in the continuity of support of the Keyword Management System and the CSW during the Common Metadata Repository (CMR) transition. Changes will result due to the transition to the CMR. IDN records will eventually move to the CMR (NASA is undertaking an initiative to merge ECHO, GCMD, IDN into a single CMR by November 2015. This will gain much new and improved functionality). All 31 CEOS members and 24 associate members will be assigned their own provider ID for metadata search/ingest for the CMR. The GCMD will be a client on top of CMR.

Yonsook added that it will be much easier to clean dead links. Mirko asked if it contains granule level data; it only will contain some granule level.

DIF-9 is transitioning to DIF-10, and a translator has been developed to perform the conversion, and fill in missing required UMM-C fields where possible. The benefits for using DIF-10 are:

* UMM-C compliance for the Common Metadata Repository
* Additional compatibility with ISO
* New Fields to describe the datasets (AdditionalAttribute, ProductLevelId, Version)
* Restructured existing fields to better describe the datasets (Platform > Instrument > Sensor hierarchy, PersistentIdentifier, and Spatial\_Coverage)

The new docBUILDER-10 Beta performs same functionality as docBUILDER-9, allowing metadata authors to add (or modify) data set descriptions (DIFs). It also writes metadata to the new DIF-10 format, validates, generates QA reports, and submit DIFs directly to the CMR. It also has enhanced inline QA Assessment of field content, syntax, verification of controlled keywords, and completeness using customized QA rules, import and export metadata to and from the Common Metadata Repository (CMR), more inline documentation with tool-tips, and supports the eight new fields and 16 restructured fields for DIF-10.

Andy said the new metadata model (UMM) is an evolution of metadata. Parameters for visualization, quality, and documentation are all mapped to ISO. It will be recommended to convert metadata records from DIF-9 to DIF-10, and the translator is available. Some new content may be required.

IDN will continue to live, on top of CMR. Operational CMR will contain all IDN records. It will be completely transparent to users.

**Action WGISS-40-13**: Michael Morahan to give a presentation on the process for translating DIF-9 to DIF-10 at WGISS-41.

**Action WGISS-40-14**: Michael Morahan to work with SEO Data Policy Portal team to update their queries in CMR.

#### CNES Technical Work to Feed the IDN [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_10.45_CNES_Technical_Work_Feed_IDN.pptx)]

Véronique Payot gave a presentation on the technical work performed by CNES to feed the IDN.

Currently, the CNES metadata repository from various thematics contains about 200 metadata records in ISO19115. The goal is to import CNES metadata from Earth Observations (~70) into the IDN. Tests with seven CNES missions (~20 metadata) have been performed; the difficulty is with mapping CNES keywords (from CNES thesaurus) and IDN keywords (from IDN thesaurus).

Seven projects have been reviewed: IASI, JASON1, JASON2, PARASOL, POLDER, SPOT, VEGETATION (working version); keyword mapping is a collaborative work between projects managers (CNES) and Michael Morahan (IDN). CNES metadata name for the IDN will be the same as CNES metadata for REFLECS + ‘\_IDN’ suffix (e.g.: 54736f5916e9134386cb9725dbbe67ae\_IDN.xml).

A script run\_inventory\_IDN.sh based on a mapping file for keywords is being created.

The IDN Thesaurus new versions is planned for March 2016 (v8.2) and October 2016 (v8.3). The IDN will keep CNES informed of IDN evolutions to upgrade the keywords mapping file (modification, addition, deletion). In addition, CNES will continue the construction of the mapping file for all CNES keywords (Earth Sciences), identifying CNES keywords without known IDN correspondences. CNES will deliver the first package of metadata (IASI, JASON1, JASON2, PARASOL, POLDER, SPOT), and prepare a second metadata package (Pleiades, Spot, Kalideos, SMOS).

Michael asked what would be the schedule for adding the CNES to the IDN. She said first metadata records will be ready at the end of October, and they plan to complete the work middle of 2016.

### Federated Earth Observation (FedEO)

Mirko Albani chaired the FedEO session.

#### Project Update [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_11.15_FEDEO_Intro.ppt)]

Mirko gave a short introduction on FedEO—a gateway system providing brokered discovery, access, and ordering capability to Canadian and European EO mission data based on HMA standards interfaces. It implements the OpenSearch OGC (and other) interfaces for an increased number of discoverable and accessible EO data collections, and for interfacing with CEOS Community Catalogues and Clients.

Mirko showed a diagram of the current brokered architecture, and one of the FedEO current operational, test, and development environments. FedEO follows the two-step search approach:

* Step 1: search dataset series (currently parallel search in 3 catalogs - see below).
* Step 2: search datasets inside the selected dataset series.

Metadata handling in the collection search includes:

* FedEO I15 (hosted/prepared on-behalf): ESA CDS, M2CS, CSCDA, ASF, and CWIC collection metadata
* Science Catalogs include ESA ScienceHub Sentinel1, CNES TAKE5, THEIA, and EUMETSAT, VITO , and DLR collection metadata
* LDS-DISSHARM collection metadata (Landsat, SeaSat)
* Live Access to ESA G-POD, ESA VA4, ESA SMOS, and to NASA ECHO, JAXA CATS-I

Mirko also explained the granule search diagrammatically.

Currently, FedEO includes metadata of collections harvested from the IDN and copied by the FEDEO Import Utility (B3.1) in EOP:ESA:FEDEO:COLLECTIONS (I15) catalog. The metadata is labelled with ‘CWIC’ keyword. Product metadata is available through FEDEO using parentIdentifier=original CWIC dataset ID or via two-step search. Collection metadata will be found if parentIdentifier is either EOP:ESA:FEDEO:COLLECTIONS or EOP:ESA:FEDEO or absent. Mirko noted that CWIC information is counted by GEODAB in the FEDEO statistics. Similar issue may arise if NASA ECHO collections would be counted; currently they are only found if parentIdentifier is EOP:NASA:ECHO.

OpenSearch access to HMA Catalogs is supporting OGC 06-131, CWIC catalogs, Virtual Archive 4, G-POD, SMOS, Science Hub, M2CS and LDS-DISSHARM, and NASA ECHO, JAXA CATS-I, CNES THEIA

Standards implemented:

* OGC 10-032r8 Geo and time Extension
* OGC 13-026r5 Extension for Earth Observation

Andy asked if they are prohibiting certain access in their portals to prevent duplication. Mirko said that the user can check and uncheck based on the selection. However, they are aware that it is something that needs to be resolved, since NASA ECHO can be returned through CWIC also. Andy suggested that this is another example of Best Practice. Andy added that another Best Practice would be performing routine status checks on all the servers/datasets. Mirko said GEO was going to use a service status checker, but were not successful. Andy noted that NASA is performing the check.

Satoko added the JAXA CATS-I is not yet fully operational.

The list of the collections accessible through FedEO needs to be consolidated into the WGISS Connected data assets website.

Mirko detailed the harmonization work that has been performed, for collection metadata format and product metadata format.

#### Demonstration and Future Work [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_11.15_FEDEO_Demo_FutureActivities_V1.pptx)]

Yves Coene gave a live demonstration of FedEO. The EO portal client’s current implementation involves a two-step search via a single OSDD endpoint (Atom responses). The GUI is built from OSDD. Pagination is based on rel="first", "previous", "next", "last" Atom information provided by server. totalResults information is no longer required. Future versions will have improved treatment of multi-word queries, auto-completion of "organisation" and "platform" based on info in Parameter extension in OSDD, broader support for "organisation" and "platform" search parameters, presentation of <link rel="icon" ../> associated with collection (e.g. Agency logo), access to ISO metadata and EOP O&M metadata from the client.

Yves demonstrated catalog and data access. Demo slides are included in his presentation. He added that the EO portal client should be accessible in the next week, and the number of collections are growing. Mirko said that SeaSat is very old, CryoSat is operational; they are both two-step searchable, and work continues to make this possible for many collections.

Ongoing and future work includes consolidation of FedEO Concept/Scenarios as part of the ESA and European EO Ground Segments, and of interfaces with existing European catalogues and addition of new catalogues. Population of FedEO Collection Metadata Catalogue for ESA and European Missions, consolidation of access from GEO DAB Broker, tests with non-European catalogues, and collaboration/ interoperability/interfacing with CWIC, NASA ECHO are also planned activities. The portal client is also being improved, as are the search responses, with improved indexing of metadata, stylesheet and geometry support, and faceted search.

API documentation includes an update of the FedEO Client Partner Guide with additional capabilities, and API documentation with examples.

### CEOS WGISS Integrated Catalog (CWIC)

Yonsook Enloe and Ken McDonald chaired the CWIC session.

#### CWIC Status [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_13.30_CWIC_Report.pptx)]

Yonsook gave a status report on CWIC, beginning with a list of data partners:

NASA, USGS, NOAA/GHRSST, CCMEO, INPE, EUMETSAT, ISRO/MOSDAC are operational. EUMETSAT is beginning to work to connect to their operational database, ISRO/NRSC is developing a connector, ROSCOSMOS and AOE are developing partners; NOAA will develop access to new and historical data and NASA will offer access to more data after IDN and CMR integration is completed.

The CWIC team is providing support for OGC CSW 2.0.2 and CEOS OpenSearch BP, have updated Data and Client Partner Guides, and are adding exceptions handling and status codes to accommodate the diversity of data providers, the data provider limitations for search and results, and error handling; this is described in the “CWIC Exception Handling Guide”. Improved measuring of search performance and monitoring up/down times for each data partner are displayed on the metrics webpage, and data counts are updated automatically, and used for a variety of purposes.

To support the organizational structure of the data, Yonsook presented two cases:

VC Case: Data producer is different organization than data distributor. For example, NOAA/GHRSST archives the data collections from many organizations. The “data producer” name is different from “data distributor”. There can be multiple data centers for one organization; to indicate the structure will require additional information in the DIF or to be harvested from the data provider or kept in CWIC internal tables. OS results do not provide this.

Identify “Virtual” collection case: Identify a subset of IDN DIFs by tagging the subset. Tags (“CWIC”) are kept outside the DIF metadata record, and the client can search the IDN for only those DIFs with specific tag. For example, the LSI team tags data collections with “LSI” tag; LSI wants to search for only LSI tagged data; LSI Portal can perform collection search at IDN for the “LSI” tagged data collections plus search criteria (keywords, space, time). After the user selects the data collection of interest, CWIC can be searched for granules.

Yonsook reported that Doug Newman produced the CEOS OpenSearch BP Developer’s Guide. Both CWIC and IDN support the CEOS OpenSearch BP. CWIC OSDD updates for (space/time) data center limitations on searches.

Future work for the team includes:

* CEOS Action VC-01 –> after the list of datasets are produced, provide support to put the data online
* CEOS VCs are maturing and have a wealth of accomplishments thus far, and data access needs are appearing on the landscape. The CWIC team will support the connection of additional data collections to CWIC, and support access to CWIC by VC clients and tools as needed.
* Connected Data Assets – will automate access from WGISS webpage to the data counts spreadsheet.

Yonsook listed the CWIC Data Partners, and noted CWIC Data Partner Responsibilities in the presentation, CWIC Support for New Partners, and the documents available on the WGISS website.

#### CWIC Partner Reports

##### ISRO [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_13.30_CWIC_Partner_Reports_ISRO.pptx)]

Yonsook presented the ISRO report for Nitant Dube.

The following two ISRO data centers are being interfaced with CWIC:

The Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC) is operational, using CSW interface; data is free only registration is required. The following Satellite and Metadata/Products are available from MOSDAC: INSAT-3D IMAGER, Kalpana-1 VHRR, and INSAT-3A CCD.

The National Remote Sensing Centre (NRSC) Integration in Progress using OpenSearch Interface; Bhuvan EO data is free and can be downloaded directly using the URL in the metadata. All other products are on chargeable basis and require registration. The following satellite and metadata/products currently planned to be made available from NRSC: Data from Bhuvan NRSC Open Earth Observation Data Archive (NOEDA), IMS-1 Hyper-spectral Data, Oceansat-2 GAC L1B products, and commercial Data (Resourcesat-2 LISS-3 and AWiFS data).

Future plans include registration of NRSC DIFS, testing and fine-tuning NRSC OpenSearch Interface, addition of more DIFS for the MOSDAC connector, and exploring possibility of enabling of OpenSearch for MOSDAC connector.

##### ROSCOSMOS [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_13.30_Roscosmos_CWIC.pptx)]

Tamara Ganina reported the status of ROSCOSMOS/RSS effort to connect to CWIC. Improvement of the web search in the Joint catalog and of the uniform catalog’s structure are complete. Mapping of meta-data parameters (Joint catalog, CWIC catalog), English interface and preparation of data descriptions and their further registration are also complete.

The team is working toward a better placement of the order button, downloading a product without making an order, and publication of a new version of geoportal in opened access.

Tamara displayed a table listing the RSS collections, with links to view the metadata. Marked in red is the open data (Meteor-M1 and Electro-L1).

##### USGS [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_13.30_USGS_CWIC.pptx)]

Kristi Kline began her presentation with a status report of the CWIC server, which is located at USGS/EROS. She noted that the server is more than five years old, and the plan is to replace it with newer system in the next year. For reasons of security, they need to implement 2-factor authentication, and move to a different area of the network (behind additional firewall, and security checks and easier management). This will provide greater network performance. Kristi showed diagrams of the architecture.

##### NOAA

Ken McDonald reported that part of the ongoing NOAA reorganization is to place all the data centres into one entity. One purpose is to develop common approaches, and this work is under way. Once these services are in place, CWIC will be able to gain access. Ken Casey is the co-lead and is the point of contact for GRHSTT. He noted that work is progressing well.

#### CCMEO [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_13.30_CCMEO_CWIC_Update.ppt)]

Brian McLeod submitted an update of the CWIC implementation at CCMEO.

##### OpenSearch API Validation [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_13.30_OS_Validation.pptx)]

Doug Newman gave a presentation on OpenSearch compliance validation. He explained that to encourage compliance, WGISS should provide specifications and best practice, audit, assist in achieving compliance, provide a public means to test their implementation for compliance, provide a private means to test their implementation for compliance, and demonstrate the value of being compliant. Much of this work has been done, and Doug went on to discuss the tool developed for OpenSearch validation.

The concept of the tool is to supply an OSDD location, and the validation tool performs a series of tests to measure compliance of the OpenSearch API. The tool is split by specification, extension and best practice. A successful test will explain to the user what has been gained; a failed test will explain what has been lost. In addition to testing the OSDD, the tool performs searches to test two-step, etc.

Currently, the validation tests for OpenSearch specification, geographical extension, time extension, ESIP Best Practices, parameter extension, relevancy extension, OGC Extension, and CEOS Best Practice. Future work on the tool includes adding scoring, profit/loss analysis of your score etc. and more validations for OGC and CEOS. Future work also includes the CEOS Developer Guide, and releasing the tool to open source.

Doug displayed an image of the CWICSMART page, and gave a live demonstration. All the tests performed on a URL were listed, along with results, where and why it failed the test, and the scoring. The tool is available now.

#### GEO/CWIC Interactions [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_13.30_GEO_CWIC_Interactions.pptx)]

Ken McDonald gave a report on GEO/CWIC interactions. He began with a status overview of GCI, which is in place and operational. The content in CSR is continually growing; the DAB supports harvesting content and distributed search of large provider systems (CWIC, FedEO, etc.); and the GEO Portal gives users a path to discover and access all GEOSS holdings. Initiatives are underway to address the inconsistent registration process and limited utilization of GEOSS and the GCI by the communities it is intended to support.

Going forward, GEOSS plans to put greater focus on GCI operations with concentrated effort to refine the registration process, and to promote, encourage and enable GCI use. This will be accomplished with Architecture and Implementation Pilots (AIP) and community portal recommendations to capture lessons learned and best practice from communities using the GCI and to construct recommendations to assist future users

Ken gave an outline of the community portal activity, and its role in the GCI. Communities will have their own specialized infrastructure. He also gave an outline of the Community Portal Recommendations document.

Near term plans include direct engagement with community projects (CEOS Water Portal, GEO Energy Portal, UNEP-Univ. of Geneva Project, GEO Biodiversity Observation Network GEO BON, and AIP projects). Other plans include harvesting lessons from community experience, continue to update recommendations document, publish journal article(s) to broaden interest.

Ken noted that GEO and WGISS have much in common: Similar objectives of respective efforts; both are building infrastructures to enable discovery, access and use of EO data though GEO has broader scope since it is not solely focused on satellite observations. GEO and WGISS both also have a rich set of data providers, and CEOS agencies through CWIC and FedEO are key GEOSS providers. Both have infrastructures with generic clients, but better services are possible with community client/portal support. NOAA and NASA continue to fund CWIC continues, but Ken is looking toward the VCs and working groups to partner to developing some of these clients. The first step is to identify potential partners.

#### CEOS OpenSearch Developer’s Guide [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/2015091001_Thursday/10.01_13.30_CCMEO_CWIC_Update.pptx)]

Doug Newman discussed the developer’s guide which was built on top of the CEOS Open Search Best Practice document and was originally a set of guidelines for interoperability of IDN and CWIC Open Search APIs, with programmatic construction of a user interface to the IDN and CWIC OpenSearch APIs. It is now a set of guidelines for general earth data OpenSearch API interoperability, for enabling the use of CWICSmart as a client to your OpenSearch API, and client and server development for OpenSearch

The CEOS Best Practices shows how to implement an Open Search implementation for an Earth science data provider. The CEOS Developer Guide has a client and server focus, shows how to link two providers together via two-step, and is a handbook for CWICSmart, IDN and CWIC system. It is essentially what was dropped from Draft 1 of the BP but still deemed useful for development. Discussion is needed on whether these should be merged, and if so, is Draft 2 of the CEOS Best Practices the candidate for this.

Y­­­oshiyuki commented that that the OpenSearch project team discussed merging the documents, but decided to keep them separate. The OpenSearch project will be closed, but we will have a dedicated task team to work on upgrades.

Ultimately the decision was to include the developer’s guide as an annex to the BP document.

# WGISS Projects

## CEOS Water Portal Project [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_09.00_Water_Portal.pptx)]

Satoko Miura opened the Water Portal Project Session reporting that the water portal is planned to be handed over to a third party entity for its operation from April 2016. As a result, the WGISS project will conclude at WGISS-41.

### Introduction and Status Report [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/pptx)]

Satoko gave a presentation on the status of the CEOS Water Portal, including the portal’s background and updates since WGISS-39. She explained the concept and services, adding that the goal is foster to participation within the water community and among other communities. Currently there are 11 data partners, and a table displayed the data types available from these.

The new water portal became available May 12, 2015 and the number of registrations and visitors are on the rise; there are 290 registered users, and around 50 users visiting per month.

A new architecture is under development which will facilitate the addition of data partners, integrate operation flow (search -> download), and allow easier operation. Satoko displayed a diagram of the new system architecture, highlighting OpenSearch and CSW access.

Satoko reported that the search interface with GEO DAB for GEOWOW river discharge data is in place. She noted that as DIAS will take over the Water Portal system operation from FY2016, the project team will focus on integration with DIAS catalog service, SSO enablement and alignment with DIAS authentication service, addition of datasets (NOAA/NCEI in-situ datasets, etc.), and input to GEOSS community portal discussion. The Water portal is accessing GEO DAB via OpenSearch for GRDC river discharge datasets. There, a speciﬁc OpenSearch query parameter “essi:sources” is used to limit the search to a single data center, which allows the search results number to be reduced and the response time to be faster.

### Input to the GEOSS Community Portal

The Water Portal team has provided input to the GEOSS community portal discussion via several teleconferences. They are familiar with the system architecture and how GEO-DAB is linked to the Water Portal. The GEO-DAB can be accessed by OpenSearch, OGC-CSW and OAI-PMH. The water portal team selected OpenSearch due to their experience and its simplicity. Based on the user requests, the target is GRDC/River discharge data; by identifying GRDC data server, response time could be shortened.

Lessons Learned and issues were identiﬁed, including:

1. How to/Manual/Guide are needed for CP developers.
2. Implementation of Opensearch interface is simple and not so difficult.
3. Since CP is (mainly) focused on the specific area (e.g., water, land, biodiversity, etc.), using “essi:sources” in the OSDD and decreasing search results is recommended.
4. Receiving too many search results causes several issues on the CP side; ranking is being considered.
5. Quality control/service level considerations should be handled, such as data access and system performance messages. Users may want to know the data quality information before downloading/using data.

### Discussion

Wyn asked if there is discussion to feed into GEO water activities. Satoko replied that they are in communication with IGWCO which is responsible for the water tasks. The GEO water community meeting was in June; the team attended and demonstrated the portal. Some feedback was received at that time only.

Yonsook asked why the sudden increment of river discharge datasets at GEO-DAB caused the search speed degradation. Satoko replied that the data center apparently added the new data entries during June-August, and the DAB harvested them; they are granule-level catalog entries of the same, single dataset.

Mirko commented that GEO’s main focus has long been on collecting as much data as possible, but they now are looking at usability improvements and planning on introducing ranking mechanism of search results and so on. More work needs to be done by GEO to make the system user-friendly; users are interested in how many million granules they can access – they are only concerned about the data they are seeking.

Yonsook said that they have noticed that when DAB harvests information from sources, it returns multiple results of the same thing. There is a lot of duplication and it is an area of concern. Mirko added that they are trying to explain to GEO that they need to use a two-step search. For most of the catalogs they should do a live search, not just harvesting regularly.

Andy wondered what WGISS can do to better communicate this to GEO. Jono suggested a concrete proposal to take to the CEOS principals, making it not so much technical as a political issue. Mirko added that once the metrics can be cleanly reported, WGISS can approach them. Jono suggested a clear page for those metrics on the CEOS website; Yonsook replied that WGISS is already working on it (with metrics updated regularly), and it would be very powerful to have this at the GEO Plenary.

**Action WGISS-40-15**: Yonsook Enloe to lead the work on the “Connected Data Assets Metrics (Data Policy Portal)” web page, which includes all known discoverable/accessible WGISS assets.

**Action WGISS-40-16**: Jonathon Ross to present the metrics at the GEO-XII Plenary, and show how to find them.

## Recovery Observatory (RO) Project [[presentation](http://ceos.org/document_management/Working_Groups/WGISS/Meetings/WGISS-40/20150929_Tuesday/09.29_09.30_Recovery_Observatory.pptx)]

Richard Moreno introduced the session explaining the concept of the Recovery Observatory. The space agencies are already well organized to respond to the International Charter, but have little or no coordination for the post-crisis part of the disaster management cycle.

The objective of the RO is to demonstrate the value of using satellite EO to support recovery from a major disaster, to establish institutional relationships between CEOS and stakeholders from the international recovery community, and to promote innovation around high-technology applications to support recovery. The duration of the RO is three years, and will coordinate acquisitions to support damage assessment, reconstruction planning and monitoring.

Richard showed the milestones from 2013 when project was proposed, to present, with the delivery of the complete version of the RO. These are an example of cooperation between two CEOS working groups. The schedule was tight, but the RO was delivered on schedule.

Richard outlined the features of the public web portal, which include collaborative groups, maps with product footprints, lists of available products, and a multi-criteria search form.

Richard noted that the main technologies of the RO are PHP, Java, and HTML5, CSS3, JavaScript, and OpenLayers. COTS used are Drupal 7, PostgreSQL, PostBIS, MapServer, GDAL, RESTo, iTag, and Mapshup. He gave additional details of Drupal CMS and Drupal Acquia Commons, as well as the Drupal/RESTo integration. There is an interaction between RESTo (stores products and metadata) and Drupal (stores documents), such as shared user session, imagery products, multi-criteria search, and easy navigation from list view to map view.

Richard showed the DotCloud Architecture diagram, and described the product ingestion, and discussed future enhancements such as adding new data formats, automatic harvesting of external OpenSearch catalogues, and interoperability with other data types such as digital images taken from a smartphone or a camera with GPS location, user documents related to a toponym, etc.

Whatever the functionalities, the success of the first instance of the recovery observatory will heavily rely on a person with the dedicated task to animate and trigger the discussions, and to feed the group contents on a regular purpose. Users will contribute and visit the group board on a regular process only if there is a steady activity in it. The WGDisasters is working on defining the triggering mechanism.

Richard next showed a video that demonstrates the RO functionality. He explained the communication groups, the product search functionality, and showed a number of features to refine searches.

# WGISS Plenary, Part II

## WGISS Terms of Reference Discussion

Wyn Cudlip reported that the CEO has requested a short (2-3 pages) terms of reference document from each of the working groups in time for the CEOS Plenary. Wyn and Michelle have been working to adapt the WGISS 5-Year Plan to fit the size and organizational requirements, and to capture the latest information from WGISS-40. Wyn agreed that having it ready for the Plenary is an achievable goal.

**Action WGISS-40-17**: Wyn Cudlip and Michelle Piepgrass to develop the WGISS Terms of Reference according to the CEO guidelines. Distribute to WGISS-all by October 26.

## WGISS Organization, Website, and Document Management Review

In response to the new CEOS website, it was agreed to display and organize the work of WGISS in “Focus Areas”, and to categorize the focus areas according to the GEO Data Management Principles.

The focus areas will be as follows, and will be displayed on the WGISS website menu in the same manner:

 Preservation (Data Stewardship Interest Group)

 Access (IDN, FedEO, OpenSearch II, CWIC, Water Portal)

 Use (Future Architecture for Data, Recovery Observatory)

Technology Exploration (Technology Exploration Interest Group)

On the website left hand menu, the following will also be displayed:

Connected Data Assets

Open Source Software

Documents

Meetings

Contact Us

The focus area webpages will need to be updated, including adding missing content. It was also agreed that recent past activities will be visible. All WGISS documents will continue to be archived in the CEOS Document Management System (DMS).

The organizational chart is shown, and will be displayed on the website, with appropriate changes as assignments are made.

**Action WGISS-40-18**: WISP to change organizational structure on the WGISS website menu and home page, based on discussion for new organizational structure.

**Action WGISS-40-19**: Richard Moreno to provide WISP with information for the RO web page by the next WGISS-Exec telecon.

**Action WGISS-40-20**: Michelle Piepgrass to develop a web page that advertises tools and services for data discovery, access and usage, and to send out a request for the content, including URL, description, SBAs, thematic areas, science discipline.



## WGISS Glossary of Terms

Mirko provided the glossary of terms document developed by LTDP. Richard thought that it would be interesting to modify this for WGISS. Mirko said many terms beyond data preservation need to be added, and suggested asking WGISS participants to review the document, with a focus on missing terms that should be added.

**Action WGISS-40-21**: Michelle Piepgrass to distribute the WGISS Glossary of terms, requesting suggestions for missing terms.

## Future Meetings

Andy announced that WGISS-41 will be in Canberra, Australia, the week of March 14, hosted by GA. The meeting will be joint with WGCV.

WGISS-42 is expected to be in North America, in September, 2016. Possible host is NASA.

## **WGISS-40 Actions**

Michelle Piepgrass reported that all actions from WGISS-39 are closed, and listed the actions resulting from WGISS-40 were agreed as follows.

**Action WGISS-40-01**: Mirko Albani to follow up with Osamu after the GEO XII Plenary for the correct mapping of IN-02-C1 to GEO Task (05).

**Action WGISS-40-02**: Andrew Mitchell and Kristi Kline to talk to the VC members at their agencies (NASA, USGS) to begin the conversation for data needs in response to VC01; by WGISS-41.

**Action WGISS-40-03**: Regarding the incoming CEOS Chair initiatives on Future Data Access & Analysis Architectures Study, the CEOS Data 03 task, and LSI support: Future Architecture for Data (FAD) team to find where these complement, and to define areas where they do not (are independent). FAD is composed of USGS, CSIRO, GA, GSDI, ESA, CNES, UKSA, and co-chairs are Kristi Kline, Richard Moreno and Robert Woodcock.

**Action WGISS-40-04**: FAD to put together the materials of Action 40-01 to present at WGISS-41.

**Action WGISS-40-05**: FAD to work with WGClimate and WGCV to come up with a plan to approach the Carbon data search relevancy, and propose it at the next SIT meeting.

**Action WGISS-40-06**: WGISS Exec to find a few of topics of cooperation with WGCapD (awareness and capacity). Ideas are the WGISS video, or a webinar on the results of the incoming chair initiative. Demonstrate how clients to get the data.

**Action WGISS-40-07**: Mirko Albani to distribute a proposal for NRT DOI, and distribute for comment on what the agencies are doing.

**Action WGISS-40-08**: Mirko Albani to consolidate the data purge alert procedure for the CEOS Plenary.

**Action WGISS-40-09**: Mirko Albani to review all the presentations on Document Preservation and present a summary and way forward proposal at WGISS-41.

**Action WGISS-40-10**: Mirko Albani to liaise with H. K. Ramapriyan to see if WGISS can contribute to ISO standard for preserved data content.

**Action WGISS-40-11**: OpenSearch Activity Team to update the OpenSearch Best Practice Document by WGISS-41.

**Action WGISS-40-12**: WGISS-Exec to determine who will lead and participate in the OpenSearch activity to update the OpenSearch Best Practice Document at the next WGISS-Exec meeting.

**Action WGISS-40-13**: Michael Morahan to give a presentation on the process for translating DIF-9 to DIF-10 at WGISS-41.

**Action WGISS-40-14:** Michael Morahan to work with SEO Data Policy Portal team to update their queries in CMR.

**Action WGISS-40-15**: Yonsook Enloe to lead the work on the “Connected Data Assets Metrics (Data Policy Portal)” web page, which includes all known discoverable/accessible WGISS assets.

**Action WGISS-40-16**: Jonathon Ross to present the metrics at the GEO-XII Plenary, and show how to find them.

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**Action WGISS-40-21**: Michelle Piepgrass to distribute the WGISS Glossary of terms, requesting suggestions for missing terms.

## Adjourn

Richard presented highlights of the meeting, and thanked UKSA and Wyn Cudlip for the wonderful hosting. He reiterated WGISS’ eagerness to continue cooperation with the UKSA team. WGISS continues to work toward wider cooperation, great activity, helpful for all.

The participants thanked Richard for his excellent leadership during the past two years of his chairmanship.

# Glossary of Acronyms

API Application Programming Interface

CEO CEOS Executive Officer

CEOS Committee on Earth Observation Satellites

COTS Commercial Off-the-Shelf

CSW Catalogue Service for the Web

CWIC CEOS WGISS Integrated Catalogue

DAAC Distributed Active Archive Center

DC Data Cube

DIF Directory Interchange Format

ECV Essential Climate Variable

EO Earth Observation

ESIP Federation of Earth Science Information Partners

GCI GEOSS Common Infrastructure

GEO Group on Earth Observations

GEO-GLAM Global Agricultural Monitoring

GEOSS Global Earth Observation System of Systems

GFOI Global Forest Observations Initiative

GIS Geospatial Information System

GPM Global Precipitation Mission

GSDI Global Spatial Data Infrastructure

GUI Graphical User Interface

IDN International Directory Network

ISO International Standards Organisation

LSI Land Surface Imaging

OGC Open Geospatial Consortium

PoC Point of Contact

SEO Systems Engineering Office

SBA Societal Benefit Area

SDCG Space Data Coordination Group

SIT Strategic Implementation Team

SST Sea Surface Temperature

ToR Terms of Reference

VC Virtual Constellation

WCS Web Coverage Service

WG Working Group

WGCV Working Group on Calibration and Validation

WGCapD Working Group on Capacity Building & Data Democracy

WGClimate Working Group on Climate

WGDisasters Working Group on Disasters