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| **World Meteorological Organization****COMMISSION FOR BASIC SYSTEMS****Task Team on Evolution of WIS**21-23 November 2017, Geneva | **TT-eWIS2017** |
| Submitted by:Secretariat 25.I.2017 |

# (DRAFT) Final report: First Meeting of the Task Team on the Evolution of WIS (TT-eWIS)

## Executive summary

1. The first meeting of the Task Team on the evolution of the WMO Information System (TT‑eWIS) was held at the WMO headquarters in Geneva from 21 to 23 November 2017. It was chaired by M dell’Acqua (France).
2. The [WIS 2.0 strategy](http://wis.wmo.int/file%3D3763) [[http://wis.wmo.int/file=3763](http://wis.wmo.int/file%3D3763)] was endorsed by Recommendation 35 (CBS-16) and subsequently endorsed by Resolution 8 (EC-69). Resolution 20 (Cg-17decided that the Commission for Basic Systems (CBS) is responsible for leading the technical implementation and operation of WIS.
3. The challenge for TT-eWIS, on behalf of CBS, is to convert the strategy into an implementable plan for approval by the Eighteenth World Meteorological Congress (Cg-18). Available time is compressed because the anticipated extraordinary session of the Commission for Basic Systems (CBS-Ext.) was not approved by EC-69. For inclusion at Cg-18, topics must have been reviewed by a constituent body; EC-70, June 2018, is the only constituent body session where the WIS 2.0 implementation plan can be discussed.
4. Prior to Executive Council, CBS Technical Conference (CBS-TECO, 26-29 March 2018) will provide members of CBS with an opportunity to understand and review the WIS 2.0 implementation plan - at least at a high level. The president CBS will include the WIS 2.0 implementation plan among his recommendations to EC-70.
5. ITT-WIS, which provides a channel for technical commission input into the operation and development of WIS, will review the WIS 2.0 implementation during March 2018 to ensure that it meets the requirements of all WMO programmes, Technical Commissions, and Regional Associations.
6. ICT-ISS (16-18 January 2018) provides an opportunity for review of initial drafts of the WIS 2.0 implementation plan.
7. TT-eWIS prepared a short “vision statement” to describe WIS 2.0:

WIS 2.0 is a collaborative system of systems using Web-architecture and open standards to provide simple, timely and seamless sharing of trusted weather, water and climate data and information through services.

1. Unpacking the above statement:
	1. “collaborative system of systems” is the term initially used in FWIS to describe a system built from the contributions of others based on an approach of accommodating their diversity
	2. “Web architecture” provides the foundation for WIS 2.0 and should ensure that weather, water and climate information is accessible to the broadest possible user base - WIS 2.0 should be part of the “Web of data”
	3. “open standards” because we want WIS 2.0 to be as inclusive as possible
	4. “simple” indicates that we strive to remove the complexity for both providers and consumers of the information shared through WIS
	5. “timely” because WIS still needs to meet the operational needs of NMHS and other organisations
	6. “sharing” covers both provision and use and is a broader concept than “exchange” or “distribution”; we will not always seek to move the data to provide access - hosted processing is increasingly necessary for “big data”
	7. “trusted” implies both authoritative and secure
	8. “weather, water and climate” are our domains of interest
	9. “through services” because WIS 2.0 moves from a data-centric to a service-centric model; data is still part of WIS, but exposed through services - services enable information to be extracted from data (e.g. creating products on-the-fly from complex data sources) and can expose complex processing through simple interfaces
2. WIS 2.0 will be a collection of authoritative services and data resources whose inclusion in WIS is authorised by Permanent Representatives of WMO Members.
3. WIS 2.0 will , (i) make it easy for service and data providers to contribute to WIS, and (ii) focus on meeting user’s needs by masking complexity with simple to use services.
4. The technologies required to meet the goals set out in the WIS 2.0 strategy are reasonably well understood; work is required to define the standards and best practices that will best enable interoperability.
5. Several organisations (ECWMF, EUMETSAT, Met Office, Meteo France, NWS, CMA and others) are developing cloud-based services that will address concerns use of big-data; these should migrate into WIS 2.0 as they mature.
6. Non-technical aspects of WIS 2.0 are equally challenging: a policy framework will be required that enables simple addition of new services - including those provided by the private sector. This is especially complex where shared cloud-based services are provided. Topics will include technical standards, data policy and cost recovery.
7. Services within WIS 2.0 should follow managed life-cycles, allowing new services to supersede old ones without impact to users.
8. The WIS 2.0 implementation plan will define
	1. a minimum set of services that are required for WIS 2.0 to be considered viable; these “basic services” will include: catalogue/search (including integration with commercial search engines), [near] real-time data distribution and product cache, monitoring & notification.
	2. A minimum infrastructure allowing GDPFS, GMAS, … to introduce their specific services on the WIS 2.0 infrastructure
9. Where possible, WIS 2.0 will leverage existing & planned infrastructure and services provided by Members and collaborating International Organisations. If basic services are not available then TT-eWIS recommend that the president CBS requests Members and collaborating organisations to consider their provision, either individually or in collaboration.
10. A much closer relationship between WIS and the GEOSS Common Infrastructure (GCI) will have to be assessed.
11. The WIS Centre roles of GISC, DCPC and NC will remain in WIS 2.0, although GISCs will likely concentrate more on monitoring and capacity building within their areas of responsibility than operating the infrastructure. TT-eWIS anticipate that there will be no need for all GISCs to operate identical infrastructure services as they do today; individual GISCs or collections thereof may undertake operation of some of the “basic services” required for WIS 2.0 to operate effectively. DCPCs and NCs will need to evolve from data-centric to service-centric provision.
12. TT-eWIS envisage working closely in partnership with existing WIS Centres to help them migrate to WIS 2.0.
13. Although yet to be determined, TT-eWIS anticipate that Centres already designated by WMO (e.g. in Manual on GDPFS) will provide services that contribute towards the mission of their sponsoring WMO programme. For example, a global NWP centre may provide hosted data processing for working with model data. Such services would be contributed into the WIS 2.0 framework.
14. The timeline for implementation of WIS 2.0 is yet to be determined. However, TT-eWIS envisage a phased migration of Centres from WIS 1.0 to WIS 2.0 over the coming years. As an indicative illustration, TT-eWIS noted that the Copernicus DIAS implementation plan spans 4-years (2018-2021).
15. TT-eWIS recommend that an agile and iterative approach is required to allow the WIS 2.0 “ecosystem” to grow; not every WIS Centre will be at the same level.
16. Given experience with the original implementation of WIS, TT-eWIS recommended that a project office, with full-time project manager, should be established within Secretariat to coordinate the WIS 2.0 implementation.
17. The work of TT-eWIS is arranged in three streams: Technical, Planning and “Soft” (e.g. people, community engagement, policy etc.).
18. TT-eWIS will prepare a document for CBS TECO that presents the “business case” for the implementation of WIS 2.0, so that, given adequate support from Members, the president CBS can recommend the plan to EC-70. The short paper (10-20 pages) should describe what WIS 2.0 is, how it is to be implementation and how that implementation will be monitored.
19. The two key deliverables of TT-eWIS are:
	1. By 2 March 2018, submit a paper for CBS TECO and review by ITT-WIS outlining the WIS 2.0 implementation plan, describing the approach to be taken and the key milestones.
	2. By 2 November 2018, submit a paper for review by Members ahead of Cg-18 that describes the WIS 2.0 implementation plan.

## Action and Decision Summary

## Actions

[**A1** Matteo Dell’Acqua (as Chair ICT-ISS) ensure that GISCs are aware of impending changes from WIS 2.0 when discussing proposals for on-site accreditation audits for GISCs (2018-2019).](#_Toc504982882)

[**A2** Jeremy TANDY to convene a teleconference (between 1-10 January 2018) to review & finalise input from TT-eWIS to ICT-ISS (16-18 January 2018).](#_Toc504982883)

[**A3** By 2 March 2018, Jeremy TANDY to submit a paper for CBS TECO and review by ITT-WIS outlining the WIS 2.0 implementation plan, describing the approach to be taken and the key milestones.](#_Toc504982884)

[**A4** Secretariat to circulate CBS TECO WIS 2.0 implementation plan paper to ITT-WIS for review and to coordinate feedback.](#_Toc504982885)

[**A5** By 2 November 2018, Jeremy TANDY to submit a paper for review by Members ahead of Cg-18 that describes the WIS 2.0 implementation plan.](#_Toc504982886)

[**A6** Secretariat and Jeremy TANDY to confirm support arrangements for TT-eWIS the three working groups.](#_Toc504982887)

[**A7** By 7 December 2017, work-stream leaders (Baudouin RAOULT, Rabia MERROUCHI, Jeremy TANDY) to write a statement of work for their work-stream and discussed it with their members.](#_Toc504982888)

[**A8** By 12 January 2018, Baudouin RAOULT (with assistance from Technical working group) to review the WIS Functional Architecture (Guide to WIS. PART III. FUNCTIONS OF WIS: 3.3 WIS Functional Architecture and separate document [http://wis.wmo.int/WIS-FuncArch]) to ensure critical functions of WIS are not forgotten.](#_Toc504982889)

## Decisions

[**D1** Participants agreed that an agile and iterative approach is required to allow the WIS 2.0 “ecosystem” to grow; not every WIS Centre will be at the same level.](#_Toc504982890)

[**D2** Oversight of the WIS 2.0 implementation shall be the responsibility of the Inter-commission Task Team on WIS (ITT-WIS). Resolution 8 (EC-69) endorsed the creation of ITT-WIS to provide a channel for technical commission input into the operation and development of WIS.](#_Toc504982891)

[**D3** TT-eWIS agreed that a project office, with full-time project manager, should be established within Secretariat to coordinate the WIS 2.0 implementation.](#_Toc504982892)

## 1. Opening

### 1.1. Welcome address

1. Fernando Belda (WMO D/OBS) opened the first meeting of the Task Team on the evolution of WIS (TT-eWIS). He noted that we spend large proportion of our time talking about WIS and information exchange: these are fundamental aspects of WMO. He referred to the two main tasks of TT-eWIS:
	1. Consolidation of stakeholder requirements for WIS, noting the participation in TT-eWIS of experts representing a broad range of WMO Programmes.
	2. The implementation plan, adding that as a colleague said, “the way to make it easy for everyone else”.
2. Fernando Belda noted the importance of the evolution of WIS and added that many communities are looking to the work of TT-eWIS. He wished the team a successful and productive meeting.
3. The agenda for the meeting is in Annex 1 and the list of participants in Annex 2.

### 1.2. Introduction to WIS 2.0 and evolution of WIS

1. Matteo Dell’Acqua, Chair of TT-eWIS, began with a tour de table and then introduced the activity relating to the evolution of WIS, which has been underway for the last 2 years. He noted that the driving concern was that many Members still have difficulty exchanging data, and that data exchange is the foundation of meteorological services.
2. The [WIS 2.0 strategy](http://wis.wmo.int/file%3D3763) [[http://wis.wmo.int/file=3763](http://wis.wmo.int/file%3D3763)] was endorsed by Recommendation 35 (CBS-16) and subsequently endorsed by Resolution 8 (EC-69). As per Resolution 20 (Cg-17), it is the Commission for Basic Systems (CBS) that is responsible for leading the technical implementation and operation of WIS.
3. The challenge for TT-eWIS is to convert the strategy into an implementable plan for approval by the Eighteenth World Meteorological Congress (Cg-18). Available time is compressed because the anticipated extraordinary session of the Commission for Basic Systems (CBS-Ext.) was not approved by EC-69. Given that topics scheduled for discussion during Congress must have been reviewed by a constituent body, the only available constituent body session where the WIS 2.0 implementation plan can be discussed is EC-70, June 2018.
4. Prior to Executive Council, it is essential that members of CBS have an opportunity to better understand the WIS 2.0 implementation plan - at least at a high level. The CBS Technical Conference (CBS-TECO, 26-29 April 2018) will provide both the opportunity to engage with CBS, and enable the president CBS to include the WIS 2.0 implementation plan among his recommendations to EC-70.
5. ICT-ISS (16-18 January 2018) provides an opportunity for review of initial drafts of the WIS 2.0 implementation plan.
6. Matteo Dell’Acqua ended his introduction by noting that although we do not have much time, many of the technologies and approaches referenced in the WIS 2.0 strategy are already being applied: we are not starting from zero, we need to use what is already in place.

### 1.3. How WIS 2.0 underpins the goals of the Commission for Basic Systems

1. Michel Jean, president of CBS, provided his perspective on the importance of WIS 2.0.
2. Today there are many weather prediction centres, collectively creating perhaps 1Pb of data each day. But less than forty of 192 Members actually have access to that information to deliver services for their citizens. The Michel Jean noted that no Member should be left behind; we must make sure that all Members can benefit from the work of the major modelling centres. Given evidence of advances in technology, he noted that there must be technical solutions that allow less developed countries to exploit this data in support of societal benefit.
3. Finally, he stated that during week commencing 4-December, a team will meet to develop the implementation plan for the future global data processing and forecasting system (GDPFS). This important work will go nowhere without WIS2.0. In terms of time- we don’t have 15 years to do this. Future GDPFS will seek to prototype in 12-18 months and WIS 2.0 is an essential component.

## 2. WIS 2.0 Strategy: what does it mean to you?

1. Participants were asked to convey their understanding of WIS 2.0, as outlined in the strategy document [[http://wis.wmo.int/file=3763](http://wis.wmo.int/file%3D3763)] (see Annex 3: Participant’s understanding of WIS 2.0 for participant’s comments).
2. Matteo Dell’Acqua summarised the participant’s comments:
	1. WIS was designed as a system of systems, but a lot has changed. WIS 2.0 seeks a more collaborative approach to establishing a system of systems.
	2. We heard about Web, Web of data, user engagement, diversity management, information (as more than data), processing, cloud, accessibility, leveraging existing components, performance criteria and working with others - including the private sector.
	3. WIS 2.0 must make it simple for users to access data, information and services - WIS 1.0 focused on metadata but did not make it easy to access the data itself.
	4. The reality of the day needs to be considered, particularly with respect to Web and cloud.
	5. Interoperability is a key challenge - within WMO and with other external organisations.
	6. WIS 2.0 will be a collection of authoritative services and data resources whose inclusion in WIS is authorised by Permanent Representatives of WMO Members
	7. Services will be a key part of WIS 2.0.
	8. WIS must continue to be an authoritative source of information - with data and services authorised by Permanent Representatives of WMO Members
	9. WIS is currently a system for experts. We need every user to have easy access to WIS [and the data and information and services it comprises].
	10. There are strong expectations from marine and hydrology community that need to be addressed in WIS 2.0.
	11. Metadata and search remain crucial to WIS. Today people search via Google [and other commercial search engines]. This may not be the best place to search, but this is where people look.
	12. We must also consider performance and service levels to support core business.
	13. Currently, the terms “data” and “information” are used interchangeably - this needs to be clarified. WIS 2.0 will bring applications to work with the data; allow users to extract the information they need at the right time.
	14. We need to stop assuming that we move data around - look at different ways (services etc.) to work with data.
	15. We need to be more open - both in terms of technology (e.g. adopting a brokering approach to translate data) and policy.
	16. We need to raise the awareness of WIS to encourage participation from Members in all Regions.
3. Given the wide-ranging aims of WIS 2.0, a “succinct vision” was proposed that can be used to guide WIS 2.0 implementation and remind us how to differentiate from WIS 1.0:

WIS 2.0 [is a collaborative system of systems] using Web-architecture and open standards to provide simple, timely and seamless sharing of trusted [weather, water and climate] data and information through services.

1. Unpacking the above statement:
	1. “collaborative system of systems” is the term used by GEOSS to describe a system built from the contributions of others based on an approach of accommodating their diversity where possible
	2. “Web architecture” provides the foundation for WIS 2.0 and should ensure that weather, water and climate information is accessible to the broadest possible user base - WIS 2.0 should be part of the “Web of data”
	3. “open standards” because we want WIS 2.0 to be as inclusive as possible
	4. “simple” indicates that we strive to remove the complexity for both providers and consumers of the information shared through WIS
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	7. “trusted” implies both authoritative and secure
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	9. “through services” because WIS 2.0 moves from a data-centric to a service-centric model; data is still part of WIS, but exposed through services - services enable information to be extracted from data (e.g. creating products on-the-fly from complex data sources) and can expose complex processing through simple interfaces

## 3. Review of current and planned data sharing systems

1. Meeting participants provided information about data & information sharing systems and infrastructure being used, developed or planned within their organisations. Links to participant’s presentations, plus a short summary for each, can be found in Annex 4: Participant’s presentations on data and information sharing systems and infrastructure.
2. Based on the presentations, participants concluded that WIS 2.0 has two aspects:
	1. technical (Web-centric approach & use of Web services; brokering to avoid imposing an overly restrictive set of standards on service providers; notifications; self-describing APIs etc.)
	2. “human” (content quality; metadata quality; governance; capacity building etc.).
3. A technical approach alone will not solve the problems that the WIS 2.0 strategy seeks to address.
4. A Web-centric approach was common to all presentations:
	1. URLs are used to identify resources - from terms in controlled vocabularies to datasets to service end-points.
	2. Web services are commonly used - using both RESTful approach and OGC Web service standards.
5. Web services (and APIs) are often provided as software-libraries for use in applications, further simplifying access to, and use of, data resources. Python was cited as a software language in common use by the WMO community.
6. Metadata, and supporting data publishers produce ‘better’ metadata (e.g. by automating metadata creation and hiding ‘technical’ aspects), will continue to be important in WIS. The current focus on metadata that describes datasets will need to be complemented with metadata for describing services and APIs.
7. Improving the user’s discovery experience was also a keenly discussed topic. Integration with commercial search engines, such as Google, was an essential part of WIS. Use of federated search, where the queries are pushed to data provider’s catalogue services, was also considered as a mechanism to ensure that users can find data that exists rather than relying on metadata collected into centralised catalogues where it can rapidly become ‘stale’ (e.g. out of sync with the resources that are available).
8. The meeting noted that brokering solutions need to be complemented with a common data model (or models) to enable data from multiple sources to be accessed consistently. For example, the Copernicus Climate Data Store uses a common data model derived from the CF-convention as the basis of interoperability in its broker architecture.
9. The meeting noted that we are at the beginning of understanding how to build and deploy cloud-based services, building on existing experience with Virtual Machines and more recently with “containerisation” of applications (e.g. using Docker). There are several initiatives where cloud is being investigated: Copernicus DIAS, Copernicus CDS, JaDE and AWS, (GEOSS) Datacube and within CMA. At this early stage in our collective understanding, we should note the differences and try to converge but avoid premature standardisation before solutions are well-proven. In addition to the technical challenges, we also need to understand the business model for cloud-based services (e.g. who pays for the compute cycles). Given the parallel developments, and recognition that multiple organisations are developing solutions to meet their needs, we conclude that WIS 2.0 will comprise of services hosted on multiple cloud environments.
10. Noting the lack of awareness of WIS reported by many participants, Paola De Salvo asked if WMO had undertaken capacity building initiatives for training centres to provide (at least) the basic “bread and butter” required for good metadata?
11. Matteo Dell’Acqua replied that capacity building did occur, but we still struggle. Perhaps because of the reliance on GTS, WIS is dominated by the needs of the World Weather Watch (WWW) programme, with 150000 metadata records that make searching for data in WIS nearly impossible. The user experience for the WIS catalogue is poor because it is dominated by metadata about GTS bulletins.
12. All agreed that, for WIS 2.0 to be a success the GTS, with it’s point-to-point routing of data bulletins over private networks, must be switched off.
13. Meeting participants considered the following points as “game changers” that would drive adoption of WIS 2.0:
	1. supporting user’s needs in all WMO programmes (not only WWW)
	2. easy access to data/information through services and APIs (not just metadata)
	3. for publishers to be clear on how to get data in, and for consumers to be clear on how to get data/information out
	4. breaking the reliance on the GTS and providing simple data access via the Web - but we will need an effective alternative for near-real-time data distribution
	5. moving from an expert system (for WWW) to a system for the community based on Web services
	6. enabling users to access the information they need for their job by providing the services/tools to extract, process and work with data
	7. for WIS 2.0 to be seen as a ‘portfolio’ of services
	8. bring the processing to the data so that a user can have a simple local ICT environment
	9. linking providers and users with models and data
	10. moving from point-to-point data dissemination over private networks to Web services
	11. reinforce ownership of WIS by the service providers: it is a collaborative system comprised of their contributions
	12. allowing marine community to easily publish and access data
	13. WIS 2.0 should be simple (to the users), inclusive, trusted, robust and available
	14. make it easy for data and service providers to contribute by respecting best practices and standards within our community
	15. it will be easy for a user to discover all the data and services they need, using standard services and common patterns (both for humans and software agents)
	16. provided targeted web services as a response to specific user needs
	17. users trust (and expect) WIS to provide the data and services they need
	18. WIS 2.0 will provide a tangible added value to what data providers already do themselves
	19. migrate from data-oriented to service-oriented architecture (even accessing data is a service)
	20. better, standards-compliant metadata that can be ingested into other data catalogues and discovery methods (e.g. commercial search engines)
	21. build on existing and proven infrastructure; encourage the use of best practices and open standards
	22. for WIS 2.0 to be easily extensible - so that new services can be added in
	23. leverage the strengths of private sector Internet leaders: Google, Amazon etc.

## 4. Use cases clarifying how users and service providers interact on WIS

1. To develop a better understanding of how WIS 2.0 will work, six Use Cases were chosen by the meeting participants (see presentation from Matteo Dell’Acqua [[http://wis.wmo.int/tdoc=408](http://wis.wmo.int/tdoc%3D408)]). In outline, the Use Cases were:
	1. Use Case 1: NMHS in developing country using global model data to run a limited-area model and deliver services to their citizens.
	2. Use Case 2: NWP centre accessing observational data (including radar data) in near real time.
	3. Use case 3: NMHS sends notification of environmental hazard (based on threshold exceedance) to centralised service.
	4. Use case 4: Application developer creates analytical tool for insurance sector based on reanalysis data.
	5. Use case 5: Calculating payback period for drainage scheme in Genoa based on simulated event bounded by climatology and climate prediction (based on scenario from Silvano Pecora’s WHOS presentation [[http://wis.wmo.int/tdoc=406](http://wis.wmo.int/tdoc%3D406)]).
	6. Use Case 6: UN employee (geospatial analyst, expert user) in Ethiopia needs to access rainfall datasets to produce a food security assessment and prepare a plan for food aid; incorporating other datasets to assess the potential impact of drought (soil type, population distribution, crop types etc.).
2. The meeting split into three breakout groups to develop these outline Use Cases and to identify the “basic services” that will be needed within WIS 2.0 to support these services. Outputs from the Breakout groups are provided in Annex 5: Use Cases as developed in Breakout Groups.
3. Matteo Dell’Acqua noted that although Group 3 had worked on policy questions such as “who can access what?”, “who pays for what?” etc. it is not the job of TT-eWIS to resolve these questions - TT-eWIS needs to define a framework that allows those questions to be resolved.
4. Capacity building was identified as a particularly important topic. Although GEOSS, for example, has worked hard to simplify the process for on-boarding new contributions so that “all data providers need to do is provide a service end-point and GEOSS will pick it up”, many organisations in the WMO community lack confidence in their ability to present a ‘service end-point’ - which could be as simple as publishing a [CSV] dataset on an HTTP server.
5. GEOSS invests significant effort into outreach and capacity building; providing training and workshops to organisations regarding the essential steps toward becoming a data provider and contributing their data.
6. EMODnet engage in similar outreach activities to help people understand the limitations and work with them to mitigate them. For example, EMODnet also offers to host datasets on behalf of data producers (as a value-added service), providing mechanisms to get those datasets ingested and hosted, and potentially provide a long-term archive and data stewardship.
7. However, outreach and training will only go so far. WIS 2.0 also needs to simply the tasks required to contribute data and services. For example, in WIS 1.0, many data producers do not understand the benefit gained from publishing complex metadata compliant with some ISO standard.
8. Simplicity is the key: if it’s not simple to contribute data and/or services, then people won’t engage

## 5. Recap of discussions so far

1. Matteo Dell’Acqua asked all participants to share their thoughts regarding what we have learned and decided about WIS 2.0 (for notes from the tour-de-table, see Annex 6: Participants comments on day 3 “where are we & what have learned or decided”), summarising as follows:
	1. WIS 2.0 will be a collaborative system of systems.
	2. It must be simple to share information and knowledge in WIS 2.0, and simpler for users to find what they need.
	3. GTS was a success story - but it is no longer fit for purpose; real-time data transfer functionality must be replaced in WIS 2.0.
	4. A lot of technologies, applications and services already exist that provide solutions to the challenges in faced by WIS 2.0.
	5. Many organisations already have, or are planning to have, services that could be incorporated into WIS 2.0.
	6. Technology is not the biggest concern.
	7. The challenge lies in defining policies that encourage organisations to contribute their services to WIS 2.0 and enable those services to be effectively used by the WMO community.
	8. GEOSS progress impressive and providers a very big inspiration; working more closely together seems like a viable option.
	9. There are still many challenges to overcome, including:
		1. How to embrace the community.
		2. How to convince key decision makers that WIS 2.0 will answer what they are looking for - and for them to invest effort in contributing their data and services into the WIS 2.0 framework.
		3. How to take account of legacy.
2. For the exact words used in the meeting, please Matteo Dell’Acqua’s slide [[http://wis.wmo.int/tdoc=415](http://wis.wmo.int/tdoc%3D415)].
3. Given the impressive progress that GEOSS has made in recent years, participants agreed to further investigate creating a much closer relationship between WIS and the GEOSS Common Infrastructure (GCI); for example, to leverage the GEOSS Catalogue/Portal and GEODAB brokering infrastructure. The GEOSS Catalogue/Portal and GEODAB broker could be treated as services within the context of WIS 2.0.
4. Participants noted that WIS has requirements, particularly relating to (near) real-time data exchange, that are not met by GEOSS.
5. Kate Roberts noted that other data catalogues harvest ISO 19115 metadata records from the WIS Catalogue. If the WIS Catalogue became a subset view of GEOSS Catalogue then the requirements from downstream users of the WIS Catalogue need to be clarified and assessed.
6. Representing GEO, Paola De Salvo noted that for WIS 2.0 to use the GEOSS platform is technically easy; for example, WIS 2.0 could have its own interface to the portal (branding) allowing search of only the WIS subset of GEOSS content. Although WMO is a cooperating organisation, political issues would need further discussion. One specific issue to consider is the applicability of GEOSS research-based funding model in supporting the long-term needs of operational WMO Centres.
7. Paola De Salvo also noted that there is still room for GEOSS to improve, and noted interested in adding things like the EMODnet “data ingest service”. Also in the pipeline is an automated “interoperability checker” for data services, which will reduce the manual effort required to validate registration of new services. Paola De Salvo noted that ESA are funded by European Commission to develop and deliver the GEOSS Portal service; with development subcontracted out.
8. Participants also noted that WIS has operational requirements; supporting 24x7 service delivery from NMHS. The GEOSS Common Infrastructure (GCI) does not have 24x7 support level: the GEOSS help-desk is manned on a voluntary basis by the GCI Operations Team (15-19 people from several contributing organisations). Service delivery at NMHS is unlikely to depend directly the Catalogue function; outage of a few hours would be inconvenient as it would interfere with operations planning. Participants noted that WMO Centres often have 24x7 operational support, which may provide a valued contribution to operation of the GCI.
9. As a first step to assess feasibility of technical Integration between WIS and GEOSS, further discussion with the GCI Operations Team is required.

## 6. Role of WIS Centres in WIS 2.0: GISC, DCPC, NC

1. Matteo Dell’Acqua asks participants to consider the role of the WIS Centres in WIS 2.0.
2. Previous discussion in the meeting suggest that the WIS Catalogue, real-time data exchange and data cache functions of WIS can be considered as ‘services’ within WIS 2.0. Participants felt that there was no longer a requirement for each of the 15 GISCs to provide the same suite of functions: through use of cloud-based solutions (etc.), it becomes possible to operate shared services.
3. Participants agreed that the role of GISCs in WIS 2.0 would focus on capacity building and quality control within their area of responsibility, rather than operating synchronised infrastructure.
4. However, even if there is only a single instance[[1]](#footnote-1) of these services (e.g. the WMO Catalogue) it must be hosted somewhere and operated on behalf of the community. It is not feasible for the Secretariat to take an operational role to manage a highly available ICT service; services would need to be operated by Members or collaborating international organisations. However, the meeting noted the plans from the Cache-in-the-cloud project where the Secretariat undertake contract management and procurement for the Cache-service, while the operations would be rotated among the GISCs according to a roster.
5. As noted previously, if WIS 2.0 were to leverage the GEOSS Common Infrastructure (GCI), it may be appropriate for GISCs to contribute 24x7 support to the operation of the GCI.
6. Lothar Wolf noted that, given the focus on services in WIS 2.0, it may be appropriate for the term GISC to change from Global Information System Centre to Global Information Service Centre.
7. From experience of GEOSS, the GISCs regional role remains very important for capacity building, outreach, quality control etc. The GISCs would retain the responsibility for ensuring the quality of metadata and supporting NCs and DCPCs in the effective provision of services.
8. Paola De Salvo noted the GEOSS Common Infrastructure is currently migrating from a single global offering to regional entities (AmeriGEOSS, AfriGEOSS etc.) to reinforce a regional presence.
9. Rabia Merrouchi suggested that GISCs take on the role of Regional Telecommunications Hub (RTH) in their area of responsibility. Noting the desire to retire the GTS, and with it the responsibilities of RTHs to participate in point-to-point transmission of bulletins and to manage routeing tables, it seems reasonable for GISCs to be responsible for the transmission of weather, water and climate information in their area of responsibility - using whatever the necessary technology. However, Matteo Dell’Acqua noted that it is essential that WIS 2.0 supports the needs of *al*l WMO programmes and avoids focusing too much on the needs of the World Weather Watch programme.
10. Luo Bing asked whether GISCs should increase the kind of data being collected, e.g. to include data from social media? No conclusions were made regarding this point.
11. Matteo Dell’Acqua summarised that the role of GISCs will remain in WIS 2.0, but the way they work will change. In the future, their role will focus on capacity building, coordination and leadership within their area of responsibility. Whether GISCs are required to operate services in WIS 2.0 remains an open question.
12. National Centres (NC) and Data Collection & Production Centres (DCPC) will remain: these WIS Centres provide the data and services for WIS.
13. Lothar Wolf suggested that a new “Cooperating Centre” (CC) designation be added. NCs are designated by Permanent Representatives to meet national concerns, and DCPCs are designated to support WMO programmes. As a “collaborative system of systems” WIS 2.0 may want to incorporate services and data from Centres that have neither a national nor programme affiliation.

## 7. Migration planning

1. As an example, that WIS 2.0 implementation may follow, Lothar Wolf to presented the planning approach conceived for the Copernicus DIAS implementation [http://wis.wmo.int/tdoc=401].
2. Lothar Wolf noted that DIAS is all about services, and there are lots of parallels with WIS 2.0. He recommended an implementation approach based on the functional blocks and their distribution among the participating organisations. (see slide 35: DIAS Functional Blocks and Responsibility Distribution). The work related to each functional block should be reasonably self-contained, enabling accountability for implementing an entire functional block to delegated to a single organisation.
3. EUMETSAT, ECMWF and Mercator Ocean brought existing systems and components in the DIAS, providing a baseline for DIAS functionality. The “integrated lifecycle” approach (see slide 12: DIAS Development Logic) allows maintenance of legacy systems during transition architecture. Once again, a similar approach may be worth adopting in WIS 2.0 to manage the succession of existing functions in WIS 1.0 such as use of the GTS for real-time data exchange.
4. An outline schedule for implementation of DIAS, covering the period 2017-2020, is provided in slide 11: DIAS Development Schedule.
5. Participants agreed that an agile and iterative approach is required to allow the WIS 2.0 “ecosystem” to grow; not every WIS Centre will be at the same level.
6. Noting the plans of ET-CAC to propose a new round of on-site accreditation audits for GISCs (2018-2019), Jan Osusky asked whether this is appropriate given the imminent changes anticipated from WIS 2.0.
7. The Secretariat responded that GISC functions will not change completely; regional coordination activities and capacity building etc. will still be required, although the emphasis on infrastructure management will likely change. As such, the new GISC audit criteria should still be largely valid.
8. Matteo Dell’Acqua (as Chair ICT-ISS) ensure that GISCs are aware of impending changes from WIS 2.0 when discussing proposals for on-site accreditation audits for GISCs (2018-2019).

## 8. WIS 2.0 implementation plan

1. WIS 2.0 will be a collection of authoritative services and data resources whose inclusion in WIS is authorised by Permanent Representatives of WMO Members.
2. WIS 2.0 will adopt a similar approach to GEOSS, (i) making it easy for service and data providers to contribute to WIS, and (ii) focus on meeting user’s needs by masking complexity with simple to use services.
3. Everything in WIS 2.0 will be considered a service; even data access is a simple service.
4. Where possible, WIS 2.0 will leverage both existing and planned infrastructure and services provided by Members and collaborating International Organisations; with services following managed life-cycles that allow new services to supersede old ones without impact to users.
5. Other than by exception (see below), CBS will not commission new services. TT-eWIS anticipate that Members (or collaborations of Members) will contribute services that already have sustainable funding.
6. If basic services are not available then TT-eWIS recommend that the president CBS requests Members and collaborating organisations to consider their provision, either individually or in collaboration.
7. Although yet to be determined, TT-eWIS anticipate that Centres already designated by WMO (e.g. in Manual on GDPFS) will provide services that contribute towards the mission of their sponsoring WMO programme. For example, a global NWP centre may provide hosted data processing for working with model data. Such services would be contributed into the WIS 2.0 framework.
8. The WIS 2.0 implementation plan will define a minimum set of services that are required for WIS 2.0 to be considered viable; the “Minimum Viable Product” (MVP). These “basic services” will include: catalogue/search (including integration with commercial search engines), [near] real-time data distribution and product cache (global and regional caches), monitoring & notification.
9. Identity management, authentication and access control are essential parts of the WIS 2.0 ecosystem. However, each service provider will determine their own approach. There is no need for a global federated identity management from day one. In due course, service providers may begin to use [global] identity management services as trusted Identity Providers (IdP) such as EduGAIN/EduROAM for research users.
10. The technologies required to meet the goals set out in the WIS 2.0 strategy are reasonably well understood; work is required to define the standards and best practices that will best enable interoperability, e.g. the agreed interfaces / APIs that will ‘glue’ together the services that comprise WIS 2.0.
11. Several organisations (ECWMF, EUMETSAT, Met Office, CMA and others) are developing cloud-based services that will address concerns regarding the use of big-data; these should migrate into WIS 2.0 as they mature.
12. The GEOSS Common Infrastructure seems to already provide many, but not all, of the basic services required for a minimum viable WIS 2.0. A much closer relationship between WIS and the GEOSS Common Infrastructure (GCI) will be assessed; for example, to leverage the GEOSS Catalogue/Portal and GEODAB brokering infrastructure.
13. Non-technical aspects of WIS 2.0 are equally challenging: a policy framework will be required that enables simple addition of new services - including those provided by the private sector. This is especially complex where shared cloud-based services are provided. Topics will include technical standards, data policy and cost recovery.
14. The WIS Centre roles of GISC, DCPC and NC will remain in WIS 2.0, although GISCs will likely concentrate more on capacity building within their areas of responsibility than operating the infrastructure. TT-eWIS anticipate that there will be no need for all GISCs to operate identical infrastructure services as they do today; individual GISCs or collections thereof may undertake operation of some of the “basic services” required for WIS 2.0 to operate effectively. DCPCs and NCs will need to evolve from data-centric to service-centric provision.
15. TT-eWIS envisage working closely in partnership with existing WIS Centres to help them migrate to WIS 2.0.
16. The timeline for implementation of WIS 2.0 is yet to be determined. However, TT-eWIS envisage a phased migration of Centres from WIS 1.0 to WIS 2.0 over the coming years. As an indicative illustration, TT-eWIS noted that the Copernicus DIAS implementation plan spans 4-years (2017-2020).
17. Oversight of the WIS 2.0 implementation shall be the responsibility of the Inter-commission Task Team on WIS (ITT-WIS). Resolution 8 (EC-69) endorsed the creation of ITT-WIS to provide a channel for technical commission input into the operation and development of WIS.
18. ITT-WIS will provide oversight for the WIS 2.0 implementation, ensuring that it meets the needs of WMO programmes, technical commissions and Regional Associations. In particular, the following activities are cited:
* WWW: seamless Global Data Processing and Forecasting System (GDPFS)
* DRR: Global Meteo Alert System (GMAS)
* PWS: Common Interface for Service Delivery (CISD)
* Marine and oceanography: Ocean Data Information System (ODIS)
* Hydrology and water resources: WMO Hydrological Observing System (WHOS) Phase-2
* GFCS: Climate Service Information System (CSIS)
1. Participants noted that during week commencing 4-December, a team will meet to develop the implementation plan for the future global data processing and forecasting system (GDPFS), and that the WMO Workshop on Information Management (WWIM, October 2017) provided useful insight about the needs of the climate community.
2. Neither CISD nor GMAS are considered mature enough to provide any meaningful requirements for WIS 2.0.
3. Matteo Dell’Acqua noted that WIS 2.0 implementation will require significant amount of coordination among Members, collaborating international organisations, WMO programmes, GEOSS, WIS 2.0 pilot projects etc. Given experience with the original implementation of WIS, he recommended appointing a project office with full-time project manager.
4. TT-eWIS agreed that a project office, with full-time project manager, should be established within Secretariat to coordinate the WIS 2.0 implementation.

## 9. Workplan

1. The key decision points for the WIS 2.0 Implementation plan are:
	1. ICT-ISS (16-18 Jan 2018): early review of draft WIS 2.0 implementation plan (high-level milestones, implementation plan structure and brief supporting notes).
	2. CBS TECO and Management Group (26-29 Mar 2018): provide members of CBS with an opportunity to understand and review the WIS 2.0 implementation plan - at least at a high level.
	3. EC-70 (Jun 2018): endorse WIS 2.0 implementation approach.
	4. Cg-18 (May 2019?): approve WIS 2.0 implementation plan.
2. For CBS TECO, TT-eWIS will need to present the implementation plan and milestones. Essentially, the document to be provided to CBS is a “business case” for the implementation of WIS 2.0, so that, given adequate support from Members, the president CBS will be able to recommend the plan to EC-70. It should describe what WIS 2.0 is, how it is to be implemented and how that implementation will be monitored.
3. The document for CBS TECO should be short: approximately 10-20 pages.
4. Documents for CBS TECO will be provided in English only; translation is not required.
5. The Secretariat noted the need for attendees of CBS TECO to provide a considered review of the WIS 2.0 implementation plan on behalf of their Permanent Representative. As such, it will be important to make documents available by the end of February 2018 to allow sufficient time for review and feedback.
6. Furthermore, the Inter-commission Task Team on WIS (ITT-WIS), which provides a channel for technical commission input into the operation and development of WIS, have agreed to review the WIS 2.0 implementation plan during March 2018 to ensure that it meets the requirements of all WMO programmes, Technical Commissions, and Regional Associations.
7. Feedback from Members and ITT-WIS will be incorporated into a draft 2 of the WIS 2.0 implementation plan submission.
8. Jeremy TANDY to convene a teleconference (between 1-10 January 2018) to review & finalise input from TT-eWIS to ICT-ISS (16-18 January 2018).
9. By 2 March 2018, Jeremy TANDY to submit a paper for CBS TECO and review by ITT-WIS outlining the WIS 2.0 implementation plan, describing the approach to be taken and the key milestones.
10. Secretariat to circulate CBS TECO WIS 2.0 implementation plan paper to ITT-WIS for review and to coordinate feedback.
11. Demonstrations of WIS 2.0 pilot applications are solicited – in particular, noting the work of the OpenWIS Association that is already underway. Pilot applications should demonstrate who value is provided to users in WIS 2.0 and not focus on technology. Silvano Pecora noted that EC-70 will have a special focus on water and anticipates being able to provide pilot applications for EC-70, perhaps for CBS TECO.
12. Following CBS TECO, the WIS 2.0 implementation plan paper will be revised and submitted by Secretariat to EC-70.
13. Development of the WIS 2.0 implementation plan can continue until November 2018, when a final draft must be submitted for review by Members as part of the consultation process ahead of Cg-18.
14. By 2 November 2018, Jeremy TANDY to submit a paper for review by Members ahead of Cg-18 that describes the WIS 2.0 implementation plan.
15. Regular teleconferences will be essential for TT-eWIS to keep up the momentum of work.
16. The work of TT-eWIS is arranged in three streams: Technical, Planning and “Soft” (e.g. people, community engagement, policy etc.).
17. Cross-cutting issues such as quality assurance, security, risk management, monitoring and reporting will be considered by all work-streams.
18. Secretariat will provide support for each of the three working groups.
19. Secretariat and Jeremy TANDY to confirm support arrangements for TT-eWIS the three working groups.
20. By 7 December 2017, work-stream leaders (Baudouin RAOULT, Rabia MERROUCHI, Jeremy TANDY) to write a statement of work for their work-stream and discussed it with their members.

### Technical work-stream

1. Lead: Baudouin Raoult.
2. Members: Sergei Belov, Thorsten Büsselberg, Erwan Favennec, Patrick Gorringe (as proxy for “someone from EMODnet”), Shuichi Ikeda, Alex Leroux, Luo Bing, Jan Osusky, Silvano Pecora, José Mauro Rezende, Paola De Salvo, Tobias Spears, Jacob Tomlinson, GEOSS Common Infrastructure operations team.
3. Topics:
* Infrastructure
	+ IaaS, SLA, Network, Security, …
* Catalogues of data & services
	+ Metadata, search, integration with commercial search engines, SEO, …
* Services and data access
	+ API & Web-service patterns, orchestration/workflow, hosted processing, PaaS, SaaS
	+ Brokers
	+ Interoperability
	+ Real-time data transfer
	+ Data-access patterns (i.e. file-transfer, data streaming, Web-services, in-situ data processing etc.); ''file-transfer is only one of many mechanisms to provide access to data''
* Interoperability requirements: technical standards and specifications
* Identity management & data policy
* Notifications
* Monitoring
* Compelling user interfaces (including UI patterns, style guides, reusable UI components, branding)
1. By 12 January 2018, Baudouin RAOULT (with assistance from Technical working group) to review the WIS Functional Architecture (Guide to WIS. PART III. FUNCTIONS OF WIS: 3.3 WIS Functional Architecture and [separate document](http://wis.wmo.int/WIS-FuncArch) [<http://wis.wmo.int/WIS-FuncArch>]) to ensure critical functions of WIS are not forgotten.

### Soft work-stream

1. Lead: Rabia Merrouchi.
2. Members: Sergei Belov, Matteo Dell’Acqua, Patrick Gorringe, Tobias Spears, Jeremy Tandy, Jacob Tomlinson, Lothar Wolf, GEOSS Common Infrastructure operations team.
3. Topics:
* Policy framework
	+ Funding model and sustainability
	+ Data policy
	+ Access / usage policy
	+ Private sector engagement
	+ Service on-boarding process(es)
	+ Service decommissioning process(es)
	+ Multi-layer governance model: a simple ''contract'' to publish data on the WIS through to advanced services supporting in-situ data processing for Big Data (WIS 2.0 must be inclusive of *all* Members, not only the technically advanced ones)
* Coordination
	+ with WMO programmes - WWW (seamless GDPFS); PWS (Common Interface for Service Delivery); DRR (Global Meteo Alert System); Marine and oceanography (ODIS); Hydrology and water resources (WHOS phase 2); GFCS (Climate Service Information System)
	+ with GEO
* Training & capacity building
* Outreach
* IPR, licensing (data, software, etc.)

### Planning work-stream

1. Lead: Jeremy Tandy.
2. Members: Kevin Alder (as proxy for “someone from MetService”), Thorsten Büsselberg, Patrick Gorringe, Rabia Merrouchi.
3. Topics:
* Migration planning
	+ Definition of WIS 2.0 “minimum viable product”
	+ GTS retirement
* Monitoring of WIS 2.0 implementation progress
* On-boarding existing and new contributions; encouraging Members and collaborating international organisations to contribute services (outreach) - note that the process for ‘on-boarding’ defined in Soft work-stream
* Topics not covered during TT-eWIS2017: key challenges, risks and issues, existing plans from Members & collaborating international organisations, gaps
* Coordination of WIS 2.0 pilots
* Coordination with ET-CAC WIS Centre audit schedule

## 10. Any other business

### Next face-to-face meeting of TT-eWIS

1. Matteo Dell’Acqua noted the provisional offer from Luo Bing, on behalf of CMA, to host the next face-to-face meeting of TT-eWIS in Beijing. The meeting objective would be to update the WIS 2.0 implementation plan in light of feedback, prior to the final version being sent out to Members for consultation.

### Upcoming RA VI Session

1. Peiliang Shi noted that the Secretariat are currently preparing a WIS document for the imminent RA VI Session (February 2018). He asked participants from RA VI to consider whether anything should be included regarding WIS 2.0.

## 11. Close

1. Peiliang Shi, WMO D/WIS, thanked the meeting participants for their dedication, and noted the worthwhile discussion regarding progression of the WIS 2.0 implementation. He added that he will provide further consideration of the request for a WIS 2.0 project office within Secretariat.
2. Matteo Dell’Acqua thanked everyone for their work. He noted that TT-eWIS2017 was a productive meeting, achieving significant progress. However, there is much more to do.
3. After thanking the secretariat for their efforts in supporting the meeting, Matteo Dell’Acqua closed the meeting at 15:59 CET.

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# Annex 1:

**1. Opening**

1.1 Welcome address, Fernando Belda (D/OBS)

1.2 Introduction to WIS 2.0 and evolution of WIS, Matteo Dell'Acqua (chair OPAG-ISS)

1.3 How WIS 2.0 underpins the goals of the Commission for Basic Systems, Michel Jean (president CBS)

**2. WIS 2.0 Strategy: what does it mean to you?**

2.1 All participants to share their understanding of WIS 2.0, as outlined in the WIS 2.0 strategy

2.1 Summary, chair

2.3 Agree common vocabulary concerning WIS 2.0 - are we all using the same language?

2.4 Agree “succinct vision” for WIS 2.0 - a simple guiding statement that can guide WIS 2.0 implementation

**3. Review of contemporary data sharing systems**

3.1 All participants to present (approx 20–mins each, more available on request) on data sharing systems and infrastructure being used, developed or planned to meet data sharing requirements within their organization that align wholly or in part with the WIS 2.0 strategy - what are we building today to meet our domestic data sharing needs?

*3.1.1 Copernicus Climate Change Service (C3S), Baudouin Raoult (ECMWF)*

*3.1.2 JaDE, Chatbots and “Big Four” (presentation), Jacob Tomlinson (Met Office)*

*3.1.3 Earth System Grid Federation (ESGF), Baudouin Raoult*

*3.1.4 ERDDAP \*Easier Access to Scientific Data\* (presentation), Tobias Spears*

*3.1.5 OpenWIS Pilot Study Briefing, Steve Olson*

*3.1.6 GEOSS Common Infrastructure (presentation) (geoportal.org, http://www.earthobservations.org/gci.php), Paola De Salvo*

*3.1.7 WMO cache-in-the-cloud project, Tobias Spears*

*3.1.8 Federation initiative at GISC Bbrasilia, José Mauro Rezende*

*3.1.9 Traffic measurement between (centralized) cloud and JMA, Shuichi Ikeda*

*3.1.10 Open Data - change of the Deutscher Wetterdienst Act in 2017, Thorsten Büsselberg*

*3.1.11 Ocean data and Information System (ODIS), Tobias Spears*

*3.1.12 Copernicus Data Interface and Access Services (DIAS), Lothar Wolf*

*3.1.13 OpenMeteo Synopsis, Erwan Favennec*

*3.1.14 Promoting WIS Implementation in RA I, Rabia Merrouchi*

*3.1.15 The Progress of Cloud Platform for Big data and AI algorithm in CMA, Luo Bing*

*3.1.16 Developments at MSC - contribution of data and metadata to WIS, Alexandre Leroux*

*3.1.17 WHOS and hydrological data sharing, Silvano Pecora*

*3.1.18 GEO / GEOSS and interoperability with WIS, Stefano Nativi*

*3.1.19 Interoperability WMO Information System and GEOSS, Thorsten Büsselberg*

*3.1.20 Overview of marine data networks, Patrick Gorringe*

*3.1.21 Ocean Data Portal (ODP) - interoperability as a WIS DCPC, Sergei Belov*

3.2 Common implementation patterns (discussion - Baudouin's note) - synthesis of common practices used in contemporary data sharing systems

**4. Develop use cases clarifying how users and data publishers interact on WIS**

4.1 Agree 6 priority use cases, Matteo Dell'Acqua

4.2 Break-out session planning, Matteo Dell'Acqua

4.3 Break-out session A (3 parallel sessions)

4.4 Break-out session B (3 parallel sessions)

4.5 Break-out group reports

**5. Recap of discussions so far**

5.1 Where are we & what have learned / decided? (Matteo's summary from the tour-de-table)

5.2 Test "new understanding of WIS 2.0" against Vision (from §2.4)

**6 Role of WIS Centres in WIS 2.0: GISC, DCPC, NC**

**7. Migration planning**

7.1 Migration approach, e.g. phased, incremental etc.

7.2 Key challenges, e.g. retiring GTS-style point-to-point message transfer (i.e. message switching), leveraging existing investment in metadata management etc.

7.3 Risks and issues

**8. WIS 2.0 implementation plan**

8.1 Existing plans from Members and collaborating international organisations to deliver WIS 2.0 compliant data sharing systems - what already exists?

8.2 Where are the gaps?

8.3 Opportunities for WIS 2.0 pilot projects

8.4 Organization and governance - roles of and responsibilities for implementation and coordination of migration activities

**9. Work plan**

**10. Any other business**

**11. Close**

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# Annex 2: Participants of TT-eWIS2017 meeting

* Matteo DELL'ACQUA (Chair OPAG-ISS, Chair TT-eWIS), France
* Baudouin RAOULT (Co-chair TT-eWIS), ECMWF
* Kevin ALDER (on behalf of Darren HALLET), NZ
* Sergei BELOV, Russian Fed.
* Thorsten BÜSSELBERG, Germany
* Paola DE SALVO, GEO Secretariat
* Erwan FAVENNEC, France
* Patrick GORRINGE, EUROGOOS/JCOMM
* Shuichi IKEDA, Japan
* Alexandre LEROUX, Canada (remote participant)
* LUO Bing, China
* Rabia MEROUCHI, Morocco
* Stefano NATIVI, Italy (remote participant)
* Steve OLSON, USA (remote participant)
* Ján OSUSKÝ, HMEI/IBLSoft
* Silvano PECORA, Italy
* José Mauro REZENDE, Brazil
* Kate ROBERTS, Australia (remote participant)
* Tobias SPEARS, Canada
* Jacob TOMLINSON, UK
* Lothar WOLF, EUMETSAT (21-22 Nov only)
* Fernando Belda (Secretariat, D/OBS)
* Peiliang Shi (Secretariat, D/WIS)
* Steve Foreman (Secretariat, C/DRMM)
* Jeremy Tandy (Secretariat, SSO/WIS)

# Annex 3: Participant’s understanding of WIS 2.0

**Patrick Gorringe**

* representing the marine community
* when we talk about WIS with the marine community - people don’t really know about it or what it is capable of
* people have put a lot of effort into trying to find out
* make it obvious what is available and how to get hold of it
* seamless access
* will there be authentication required - or will it be just click and go
* want to get more marine data into WIS - but only if they can get their data back out again
* looking for a win-win for WIS and marine
* easy to reach, to find, to download
* very few marine institutes are aware of WIS
* there are a couple of data aggregators out there who can translate datasets - will WIS act in this way, or will data publishers have to adapt to fit; will WIS accept almost any types of data?
* data policy is a key challenge here

**Tobias Spears**

* WIS 2.0 is a change in thinking
* an expansion and opening of the doors - to be more interoperable
* work with what is already there
* Web centric
* more interoperability
* marine community is in the same place [as WIS - wanting to achieve the same things]
* federated view of disparate sources
* the boundary between structured and unstructured data is blurring
* need to use Web architecture
* inclusive - some regions are not connected to WIS today
* WMO is not going to build all of it itself
* WIS needs to look at the ‘contracts’ and standards to work with other communities - a standards layer
* there will be lots of entry points into WIS - aggregators, translators, publishers
* WIS 2.0 needs to make those connections easier
* leveraging the aggregators will provide quick wins
* WIS 2.0 will form part of the marine [data] network
* there will be governance challenges - but data is the life blood of the community
* many National Oceanographic Data Centres struggle to get data in - they need help in getting the data into the system
* so we need to agree the standards and architectural patterns to enable everyone to work together
* finally, remember that WMO has an operational data exchange network with service level agreements - this is core business
* need SLAs and accreditation in place to ensure that the core business is not impacted
* core business needs to work along side delayed mode push

**Sergei Belov**

* it is a new vision for the WIS
* it improves the usability of WIS
* when talking with my national colleagues, I get many critical questions
* metadata should be more ‘alive’ - showing the data that is actually available (e.g. from GTS)
* metadata is living a different life to data
* we need to keep the data and metadata [strongly] linked
* need better links to other resources - OSCAR surface, the [observing] platforms
* we have 15 GISCs with different tools - this creates a problem
* users want easy metadata creation
* will we have common tools for metadata creation in the cloud
* giving access to metadata catalogues is not enough - we want access to data
* [we need platforms to work with big data]
* who is searching & downloading our data  - we need analytics to know who is doing what [so we can improve service]
* the strategy is really challenging - we need to concentrate on the critical services rather than the trendy technologies

**Erwan Favennec**

* we want to make data available to a wider range of users
* but we have an exponential increase in volume of data
* we need [a new mechanism] to meet user’s requirements
* if we host user’s applications, we need to manage our resources - to control peak demand
* security requirements will be crucial - and not everyone has the same level of constraints on IT security
* we want users to be authenticated and authorised in WIS 1.0 - will this still be necessary

**Rabia Merrouchi**

* we are making a big step forward
* previously there was a focus on metadata - but now we move to data access and availability
* the most important thing in the strategy is that it seeks to address user’s needs - provide access to added value product, not only raw data
* WIS 2.0 will need to use open platforms - and to use standard protocols
* need to integrate new trends in technology
* we have a new vision
* we need effort from all WMO programmes and external partners

**Jan Osusky**

* need to address problem with data discoverability and addressability
* we have issues with granularity of data
* sometimes data is too big to move
* need services to access data
* the strategy is good - but it needs to be implemented

**Kevin Alder**

* in Region V we have many Small Island states that struggle with technology and data access
* these are some of the countries most impacted by climate change
* the awareness of WIS in Region V is low
* need to ensure that we engage the user community - not just focus on technology platform
* like the idea that we are taking off the shelf components and deploying them
* need to ensure that we aren’t missing any key components
* but its removing complexity
* need to really understand those components
* WIS 2.0 increases the accessibility of data
* WIS 2.0 will need clear performance SLAs (for end-to-end data transmission) - people will be using this information for critical safety services

**Thorsten Büsselberg**

* this strategy is a big change
* WIS 1.0 is an evolution of the GTS - with a catalogue attached
* it’s a system for the experts
* WIS 2.0 is system for the community
* there is lots of talk of new technology - cloud solutions, big data
* these are similar concerns to those of space agencies. ESA etc.
* [we can share our thinking and resources]

**Jacob Tomlinson**

* lots of new technologies that are already being applied in existing systems
* data and information seems to be used interchangeably
* a big difference between ‘bytes on disk’ and the ‘information’ contained there
* products do this in some way
* can we provide a mechanism to enable people to extract information from those bytes on disk - to create products on the fly - using compute resources in the cloud etc.

**Silvano Pecora**

* WIS 2.0 is important for hydrology community
* WMO Hydrological Observing System (WHOS) is well-aligned with most of the aspects of WIS 2.0
* collecting information from many data providers using standards
* WHOS is not developing a separate system - only the missing bits from WIS and WIGOS
* in its current form WIS only talks about meteorology - doesn’t mention hydrology
* but WIS should be the infrastructure for moving our data [or providing access to data]
* seek to increase the priority of [access to water data]
* it is crucial to disseminate the data that we collect - to support water resource management
* we strengthen water resource monitoring networks
* but we need to improve water data management and data exchange
* hope that together we can integrate information from different domains into practical applications to support societal benefit

**Shuichi Ikeda**

* WIS plays an important role in the dissemination of hydrological and meteorological data
* WIS 2.0 will provide seamless access to all types of data - this is challenging
* to be costs effective it will use industry standard technology - cloud and web standards
* WIS 2.0 will facilitate sharing of information at the right time with the right people

**Luo Bing**

* in China we work to improve data storage systems [etc] by use of public cloud
* this is very important for the evolution of the WIS
* the boundary of the WIS is important - we have been concerned with the data, but now we should be concerned with the applications and services too, for research [and operations]
* also how WIS can support commercial areas
* encourage more users to use our data - including developing countries
* cloud technologies are developing very quickly - we should [embrace] these technologies

**Paola de Salvo**

* refers to opening statements: “a lot of pieces are already there” and “we don’t have a lot of time”
* share experience from GEOSS
* leverage the power of brokering infrastructure
* interoperability is handling multiple standards with out imposing on data publishers
* this allows more data publishers to join the community
* GEOSS has defined data management principles
* communicate to data providers that metadata is crucial for helping data be discovered
* data providers are the owners of this metadata
* the metadata is the only way to describe their data so that people will discover and use it
* data (and metadata) ownership & the responsibilities of owners is an important area
* need to provide interfaces for humans and software (Web services)
* there is always room for improvement - continuous involvement with both data providers and data users
* users can be classified into types - those interested in raw data, and those interested in [products and applications]

**José Mauro Rezende**

* need to make WIS more visible, more understandable

**Alexandre Leroux**

* agrees with what has already been said

**Stefano Nativi**

* WIS 2.0 is about a system of systems - it is a system of systems already
* but I see a change of governance; today it is directed, but in future it looks to be a more collaborative approach which is more in line with the contemporary landscape
* clearly, this entails some challenges …
* when you build a collaborative system of systems, you need to pay more attention to diversity management - you cannot control so much so you need to accommodate larger variety
* we are talking about geospatial data here - so consider existing solutions from other domains, but keep in mind that space and time is important in our domain
* the technology landscape is changing - cloud, big data, Web 3.0
* we have to move from data infrastructure to a service(s) platform
* Web 3.0 is the Web of data - there will be a global data market, including earth observation data
* we are not alone
* interoperability is crucial
* the challenge is how to manage interoperability - how to be more open to other systems [and information providers]
* need to move from data to information and perhaps even to knowledge
* these three concepts should be defined in the WIS 2.0 strategy
* WIS 2.0 should be clear how it moves from data (discoverability and access) to information (processing, analytics)
* experience & lessons learned from GEOSS - diversity management, discoverability, accessibility
* GEOSS is evolving (again) - to embrace analytics and processing to move from data and information
* this is a good opportunity to build some synergies between GEOSS and WIS

**Kate Roberts**

* supports comments on metadata - to make data visible
* Google is important - but it gives different results to different people to ‘improve the relevance’ of search results
* but need to work on improving data discoverability within the curated “aggregator” catalogues (or just “data catalogues”)
* Google [and other commercial search engines] have adhered to policies that limit access (for some users) to some resources
* Google (unlike a data catalogue) captures who is searching for what and reuses that data for commercial gain; e.g. privacy issues - a community data catalog doesn’t do this.
* would like to see a clear connection between google and "reliable", authoritative data catalogs rather than bypassing of aggregator data catalogs)
* recognise that Google is where users might start looking for those authoritative data catalogs!

**Steve Olson**

* publicly accessible data means different things to different agencies - policy and regulations will play a key role
* from an accessibility standpoint, REST APIs will play a key role
* from a reliability standpoint, we need to recognise that eventually we will have mixed environment with the cloud and local system pieces - does consistency matter?
* also if the solution goes more cloud based, does the primary and backup in the cloud with multiple instances make more sense than a geographically driven solution?

(see written submission [[http://wis.wmo.int/tdoc=395](http://wis.wmo.int/tdoc%3D395)])

**Baudouin Raoult**

* when WIS started, it was 1998 - the same time as Google was founded
* a lot has changed
* the landscape is very different - particularly the Web and cloud
* no one goes to a WIS Portal, people do a Google search - if we can’t do this we have failed

**Fernando Belda**

* WMO are the Members - it is they that have the capacity
* WIS 2.0 needs to operate in the same way - to [orchestrate] the systems and data from others as this is where the capacity is
* we need to include meteorology and hydrology and marine

# Annex 4: Participant’s presentations on data and information sharing systems and infrastructure

**List of presentations**

|  |  |  |
| --- | --- | --- |
| Agenda item | Presentation title | Participant |
| 3.1.1. | Copernicus Climate Change Service (C3S) | Baudouin Raoult |
| 3.1.2. | JaDE, Chatbots and “Big Four” | Jacob Tomlinson |
| 3.1.3. | Earth System Grid Federation (ESGF) | Baudouin Raoult |
| 3.1.4. | ERDDAP \*Easier Access to Scientific Data\* | Tobias Spears |
| 3.1.5. | OpenWIS Pilot Study Briefing | Steve Olson |
| 3.1.6. | GEOSS Common Infrastructure | Paola De Salvo |
| 3.1.7. | WMO cache-in-the-cloud project | Tobias Spears |
| 3.1.8. | FEDERATION INITIATIVE AT GISC BRASILIA | José Mauro Rezende |
| 3.1.9. | Traffic measurement between (centralized) cloud and JMA | Shuichi Ikeda |
| 3.1.10. | Open Data - change of the Deutscher Wetterdienst Act in 2017 | Thorsten Büsselberg |
| 3.1.11. | Ocean data and Information System (ODIS) | Tobias Spears |
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| 3.1.13. | OpenMeteo and Synopsis | Erwan Favennec |
| 3.1.14. | Promoting WIS Implementation in RA I | Rabia Merrouchi |
| 3.1.15. | The Progress of Cloud Platform for Big data and AI algorithm in CMA | Luo Bing |
| 3.1.16. | Developments at MSC - contribution of data and metadata to WIS | Alexandre Leroux |
| 3.1.17. | WHOS and hydrological data sharing | Silvano Pecora |
| 3.1.18. | GEO / GEOSS and interoperability with WIS | Stefano Nativi |
| 3.1.19. | Interoperability WMO Information System and GEOSS | Thorsten Büsselberg |
| 3.1.20. | Overview of marine data networks | Patrick Gorringe |
| 3.1.21. | Ocean Data Portal (ODP) - interoperability as a WIS DCPC | Sergei Belov |

**3.1.1.** [**Copernicus Climate Change Service (C3S)**](https://climate.copernicus.eu/)

Baudouin Raoult presented on the Copernicus Climate Data Store (CDS) (presentation) [[http://wis.wmo.int/tdoc=398](http://wis.wmo.int/tdoc%3D398)].

The CDS will contain past, present and future data in terms of essential climate variables.

Key technical points include:

* use of a broker approach with adapters to allow interoperability with many data sources.
* broker implements queuing and quality of service.
* common data model provides the basis for interoperability - all the information is “the same shape” (time, space, parameter etc.), it can be translated between formats, units etc.
* common data model is based on the CF-convention
* toolbox provides functionality for applications; allowing application developers to write high-level python to work with the data resources - the ‘infrastructure’ is taken care of by the platform
* application developers create tools for end users
* all running in the private cloud in ECMWF compute centre (sole user of this facility) - but cloud services themselves not exposed to the end-user, access is provided by Web browser
* based on open source technologies
* monitoring and reporting integrated into the platform
* based on Web architecture - everything is based on URLs
* RESTful Web-services, JSON formats [for controlling & configuring the application]
* not allowing users to run their own code (only allowed to use pre-loaded Python packages installed in the platform) - applications will be vetted to ensure that they meet the quality criteria for Copernicus
* ISO 19115 data is not sufficient - need to complement it will data for describing data access
* the toolbox is a significant addition, allowing “small and medium sized enterprises” to work with climate data without having to invest in infrastructure

**3.1.2.** [**JaDE**](http://informaticslab.co.uk/projects/jade.html)**, [Chatbots](http://informaticslab.co.uk/projects/facebook-chatbot.html) and “Big Four”**

Jacob Tomlinson presented on innovations at the Met Office: Jade, Chatbots and Big Four (presentation) [<https://docs.google.com/presentation/d/1rEgH0lwdxO8ESk166YSltpmuzuLT_IzLROu0yMUxJ8s/edit?usp=sharing>].

The Big Four project is moving the data production activity for the four main global weather models into the Amazon cloud, using S3, Direct Connect and Simple Notification Service. Also publishing large scale datasets to AWS S3.

But “dumping terabytes of data to S3 is not enough”. Mostly we see large organisations downloading the whole dataset and working offline. We are trying to help smaller organisations and individuals to work with the data by providing tools.

JaDE is a platform based on open source components that enables users to write Python applications that work with data in the cloud. Crucially- we need to be “lazy”. For example, Jupyter avoids moving data unless it really has to: push the Python to where the data is rather than pulling the data to your compute. Iris (data library for working with multi-dimensional earth observation data) uses metadata figure out how to minimise what data it actually needs to pull into memory. Dask allows problems to parallelised in an efficient method. JaDE has been configured to effectively work on Amazon Web Services cloud.

Have also been looking at user interactivity - via chatbots, e.g. Alexa. The chatbot is using JaDE, for example, behind the scenes to distill huge volumes of data into useful data. A simple question to a chatbot invokes tens of Gb of data - but very quickly.

These mechanisms clearly illustrate how access to huge data sets can be provided to everyone; either in a browser or through a chatbot. For example, you could ask “should I put up my flood defences today”.

RESTful web architecture pattern.

**3.1.3.** [**Earth System Grid Federation (ESGF)**](https://esgf.llnl.gov/)

Baudouin Raoult provided a very quick overview of the Earth System Grid Federation. It is a peer to peer mechanism to share data for IPCC Climate Model Inter-comparison Project (CMIP). CMIP6 will host 200Pb of data. It uses the Unidata software stack (netCDF and THREDDS etc.). Access is controlled via openID. OGC Web services are included it the services stack. A common data model is used: a stricter use of CF-conventions.

**3.1.4.** [**ERDDAP \*Easier Access to Scientific Data\***](https://coastwatch.pfeg.noaa.gov/erddap/index.html)**,**

Tobias Spears provided an overview of ERDDAP (presentation) [[http://wis.wmo.int/tdoc=394](http://wis.wmo.int/tdoc%3D394)].

Environmental Research Division’s Data Access Program (ERDDAP) is one of many technologies that provide a data brokering solution. It is a catalogue and a server, using a broker-based approach similar to the Copernicus CDS. ERDDAP is open source: you can run your own ERDDAP instance.

The ERDDAP user interface is deliberately plain - but can be easily customised. It is Web centric and can be integrated into existing application and systems.

ERDDAP is designed to support system to system data access as well as providing user interfaces for users. It uses Web services / APIs, FGDC and ISO 19115 metadata and support for Web Accessible Folders (WAF) which enable a simple publication of data and (often) automated creation of metadata.

OpenDAP is at the heart of this system. Search digs into the data to find what is available - not relying purely on metadata records. Many different types of search are provided - from free-form text, to geographic and temporal boxes.

ERDDAP supports both simple and advanced users. It allows one to wrap complex systems (with particular data formats etc.) to provide simple access to the data by taking away the challenge of working with a ‘foreign’ data format.

ERDDAP allows you to support both expert users and simple users.

Sergei Belov noted that JCOMM’s OpenGTS pilot project uses ERDDAP to enable marine community data to be converted into BUFR and published onto the GTS.

Secretariat note that we’ve heard many times already broker services. Crucially, WIS 2.0 does not need to build another broker services- we can leverage what already exists.

**3.1.5. OpenWIS WIS 2.0 pilot, Steve Olson**

Steve Olson presented on the work of the OpenWIS Association to undertake a pilot study for WIS 2.0 (presentation) [[http://wis.wmo.int/tdoc=400](http://wis.wmo.int/tdoc%3D400)].

The OpenWIS Association is a non-profit organisation committed to the development of open source software for meteorological data exchange.

The OpenWIS Association work plan now includes a “pilot study” to develop WIS 2.0-like functionality based on a user-centred narrative, focused on data exchange within developing countries. A demonstration is planned to be available for CBS TECO 2018.

**3.1.6. GEOSS Common Infrastructure**

Paola de Salvo presented on the GEOSS Common Infrastructure (GCI) and GEO Foundational Tasks (GD 02) ([presentation](http://wis.wmo.int/tdoc%3D363)) [[http://wis.wmo.int/tdoc=363](http://wis.wmo.int/tdoc%3D363)].

GEOSS has exposes more than 166 brokered data catalogues with content from over 5000 data providers through the GEODAB broker and the GEOSS Portal. GEO does not own a single dataset; ownership resides with the publisher. The GEOSS Yellow Pages provides a simplified mechanism for data providers to register with GEOSS. The GEO Status Checker monitors whether services from data publishers are available.

The GEOSS Common Infrastructure does not impose data formats (etc.) on the data provider; it handles a suite of the most common open data formats and provides a set of well-defined APIs.

There are two entry points: the GEOSS Portal and the APIs from the GEODAB broker.

OGC Web Map Service (WMS) and KML can be visualised in the Portal if provided by the data provider.

GEO is very respectful of the data provider’s license, although it gently pushes to encourage use of licenses that permit free and unrestricted re-use (e.g. open data).

GEODAB supports more than 50 standards. Whenever a new data format or access protocol is encountered, GEODAB may be modified to incorporate this.

Human interoperability is equally important to technical interoperability: with implementors and data providers spread around the globe.

The simplified registration workflow (GEOSS Yellow Pages) encourages would-be data publishers to undertake self assessment of their own data management practices. Interoperability tests provide data publishers with a clear statement of what to fix; the registration process is useful for data publishers too.

The GEOSS Portal has evolved to support mirror portals and widgets that can be incorporated into Web sites.

The GEOSS Catalogue supports the main metadata standards used by the data producers; inclusive of ISO 19115, Dublin Core, FGDC etc. Minimum essential metadata is defined from a content perspective. The GEOSS Portal always a link back to the original metadata record.

GEOSS View allows a subset of the GEOSS resources to be defined (and re-used within the community) by applying a set of clauses. Developments to customise the interface for domain specific groups, e.g. GCOS require search base around the Essential Climate Variables, thereby providing different views into the GEOSS Catalogue.

Engaging with the community is essential. Data Providers workshop is a successful mechanism to achieve this - with over 95 organisations present in the last workshop.

GEOSS are also recording impact from the data, but describing how the data is used.

Where possible, software is developed under open source license. GEOSS Portal is currently not open source (provided by ESA). The GEODAB APIs are working with OGC to publish them as an open standard.

Also see URLs [geoportal.org](http://geoportal.org) and <http://www.earthobservations.org/gci.php>.

**3.1.7.** [**WMO cache-in-the-cloud project**](http://wis.wmo.int/tdoc%3D387)

Tobias Spears presented on the Cache-in-the-cloud project (presentation) [[http://wis.wmo.int/tdoc=387](http://wis.wmo.int/tdoc%3D387)].

The Cache-in-the-cloud project aims to use a cloud-based shared service for sharing data-files between the 15 GISCs, thereby helping achieving the 2-minute end-to-end transmission of warnings.

The scope of the technical service in the initial phase is quite simple (cyber security, failover and geographic redundancy aside) in order to get a much better control of costs. In addition, this project looks at the financial and governance mechanisms that might be used to deploy shared services in the cloud for the WMO community.

**3.1.8.** [**FEDERATION INITIATIVE AT GISC BRASILIA**](http://wis.wmo.int/tdoc%3D319)

José Mauro Rezende presented details of the user federation initiative at GISC Brasilia (document) [[http://wis.wmo.int/tdoc=319](http://wis.wmo.int/tdoc%3D319)].

User authentication & authorisation is a necessary component for many services. EduGAIN / EduROAM provides a mechanism to authenticate users from the global research community comprising many hundreds of institutions.

**3.1.9.** [**Traffic measurement between (centralized) cloud and JMA**](http://wis.wmo.int/tdoc%3D358)

Shuichi Ikeda presented on performance considerations about moving data into and out of the cloud, based on the Cache-in-the-cloud project (presentation) [[http://wis.wmo.int/tdoc=358](http://wis.wmo.int/tdoc%3D358)].

When using the cloud to distribute data, it is necessary to procure sufficient bandwidth connectivity. However, bandwidth can be used efficiently by using parallel (3x) SFTP sessions when compared to a single SFTP session. Bandwidth is not the only consideration: need to consider “round trip time” (RTT) - particularly when transferring many small files (such as bulletins).

Use of cloud makes data access easy, but challenges include cost and network (Internet) performance.

TT-eWIS concluded that the data transfer rates illustrated in the presentation are very low. EUMETSAT distribute multiple terabytes in a few hours; it is a protocol issue. Care needs to be taken to select the right protocol for efficient data transfer.

**3.1.10.** [**Open Data - change of the Deutscher Wetterdienst Act in 2017**](http://wis.wmo.int/tdoc%3D385)

Thorsten Büsselberg presented on open data issues at DWD (presentation) [[http://wis.wmo.int/tdoc=385](http://wis.wmo.int/tdoc%3D385)].

The German government changed the responsibility of DWD to publish [all?] data as open data. This means they now have responsibility to publish approximately 200GB of geodata per day through [opendata.dwd.de](http://opendata.dwd.de) and 1 GB per day for map layers at [maps.dwd.de](http://maps.dwd.de).

**3.1.11.** [**Ocean data and Information System (ODIS)**](http://wis.wmo.int/tdoc%3D391)

Tobias Spears presented on the JCOMM Ocean Data and Information System (ODIS) (presentation) [[http://wis.wmo.int/tdoc=391](http://wis.wmo.int/tdoc%3D391)]*.*

The marine community are struggling with the same challenges as the meteorological community. At a minimum, the marine community would like a “one stop shop” for marine data - basically, what they thought the internet would do for them 10-years ago.

Key trends include:

* persistence of legacy practices
* moving to a Web-centric approach
* continue to add sophistication
* trying to drive simplicity [in the whole by making the efforts of data publishers more complex]
* not respecting the capability maturity of data providers

UNESCO IOC performed an audit in 2016, and concluded that there was no single mechanism to find marine data resources. They recommended that this was remedied - and hence the Ocean Data Information System (ODIS) was born.

JCOMM IODE developed a concept paper for ODIS. Included therein is a list of the barriers to participating in the data sharing networks:

* disparities in representation
* disparities in technical capabilities and knowledge
* disparities in technical environment/capacity
* disparities in human capacity

ODIS has many classes of users: expert users, general users and software systems (for system-to-system interchange).

For quick wins, ODIS recognises the need to leverage existing data aggregators and data providers; essentially, this makes ODIS a system of systems.

Examples that can be incorporated into ODIS include:

* **Technology** - GeoNetwork, pycsw, CKAN, ERDDAP, ODP, GEOSS Common Infrastructure (CAT, DAB), GeoServer/ArcGIS Server, …
* **Systems** - GEOSS, GOOS, SeaDataNet/Cloud, …
* **Standards** - WMO Core, Harmonized North American Profile of ISO 19115, Darwin Core, ...
* **Best Practices** – ISO, OGC, W3C, others

In conclusion:

* Consider the users and the providers
* Break down barriers to participation – be inclusive, collaborate
* Variety is a reality
* Ensure data is well managed through the data lifecycle
* Know your requirements and service levels

**3.1.12. Copernicus Data Interface and Access Services (DIAS)**

Lothar Wolf presented on the Copernicus Data Interface and Access Services (DIAS) (presentation) [[http://wis.wmo.int/tdoc=401](http://wis.wmo.int/tdoc%3D401)].

EUMETSAT are working in collaboration with ECMWF and Mercator Ocean on developing the DIAS.

DIAS is implementing an information centric service infrastructure. Crucially, computation should be where the data is. There are six pathfinder projects covering a range of issues from data delivery to online access, to hosted processing etc.

Legal and policy assessment is included in the project: legal analysis of use of commercial cloud providers, data policy analysis, legal analysis of overarching access and usage terms (who can use the service and for what).

Two cloud stacks are require to support different use cases: (i) hosted processing, and (ii) mission critical aspects.

Seven use cases have been developed to guide development of the DIAS.

For tools and processing services, intent to deploy VMs (cloned from an image with domain-specific sets of tools) onto the DIAS cloud (an Apache Spark cluster [using OpenStack?]). The VMs will have access to the data at “LAN speed” (implementation mechanism to be determined).

The common data access API is based on simple RESTful APIs (following the pattern seen in OpenStack); the pattern is “request in, URL out”. This is similar to OGC WPS, but purely RESTful with JSON request payload. This can work to invoke services to process data or simply access data (data access is a kind of service to invoke). These services can be chained together within the toolbox framework.

Legacy APIs, e.g. extracting data from MARS archive, can be wrapped by simple adapters.

RESTful API calls can be chained together in python scripts to develop applications.

The DIAS will provide a Point of Presence (PoP) at ECMWF, EUMETSAT and a commercial provider to create an ecosystem of data, services and hosting. APIs to the ecosystem will provide access to users and external data providers.

Operational deployment is scheduled for 2018Q4.

**3.1.13.** [**OpenMeteo Synopsis**](http://wis.wmo.int/tdoc%3D392)

Erwan Favennec introduced the OpenMeteo and Synopsis platforms from Meteo France (presentation) [[http://wis.wmo.int/tdoc=392](http://wis.wmo.int/tdoc%3D392)].

Meteo France’s production chain has been redeveloped using a service oriented approach, orchestrated using via the WSO2 Enterprise Service Bus.

Both OGC Web Services and RESTful Web services are used. Data is cached to improve performance. Approximately 70 Web services are provided, supporting 2 million requests and serving 2 Terabytes of data per day.

The OpenMeteo gateway provides controlled access to these services. API management (e.g. “throttling”) is required to manage bandwidth etc.

Synopsis is an interactive visualisation tool for expert users. It is Web-oriented and based on OGC standards.

**3.1.14.** [**Promoting WIS Implementation in RA I**](http://wis.wmo.int/tdoc%3D393)

Rabia Merrouchi presented on efforts within the RA I to support WIS implementation (presentation) [[http://wis.wmo.int/tdoc=393](http://wis.wmo.int/tdoc%3D393)].

There was a lack of awareness of the role of WIS and of its technical specifications, with confusions between technical benefit and other benefits, thereby favouring a migration of NCs and DCPCs towards GISCs of developed countries.

Metadata in WIS is dominated by records describing GTS bulletins.

Involvement from the WIS National Focal Points is essential - but in many cases, it is not clear who they are.

Metadata generation / creation is still a concern. GISC Casablanca promote the use of tools to help the generation of metadata and propose a pilot study to work with NWP centres to help [improve?] metadata.

Rabia Merrouchi noted that RA I Members are keen to adopt Web services to make it easier to use data to deliver their services - which aligns well with WIS 2.0. However, he wondered whether the Internet would be sufficiently available at necessary capacity to support all Members.

**3.1.15.** [**The Progress of Cloud Platform for Big data and AI algorithm in CMA**](http://wis.wmo.int/tdoc%3D396)

Luo Bing described the use of cloud platform for big data and artificial intelligence (AI) algorithms within CMA (presentation) [[http://wis.wmo.int/tdoc=396](http://wis.wmo.int/tdoc%3D396)].

Numerical weather prediction resolution for the Chinese regional model has moved from hours to minutes and spatial resolution from 50km to 1.5km. Taking into account data coming from other sources, data resource volumes are expected to exceed 100PB in 2020.

Cloud computing services are required for processing, mining and analysing data. CMA intend to establish a hybrid cloud to support these requirements- combining private and public cloud elements. Alibaba cloud is used for public cloud offering.

The cloud service platform enables provincial centres to work with the global datasets in delivering meteorological services.

CMA seek to combine meteorological data with industry and social data to develop intelligent data services based on big data storage and data analytics. CMA is investigating use of neural networks and machine learning to support service delivery.

CMA are still evaluating implementation patterns for data storage and compute resources needed to support data analytics and machine learning, across both private and public cloud.

**3.1.16.** [**Developments at MSC - contribution of data and metadata to WIS**](http://wis.wmo.int/tdoc%3D397)

Alexandre Leroux provided information on the technological environment at MSC, WIS metadata and public data dissemination through MSC Datamart and MSC GeoMet (presentation) [[http://wis.wmo.int/tdoc=397](http://wis.wmo.int/tdoc%3D397)].

MSC output in excess of 10 terabytes per day and have an archive of 12 petabytes.

Metadata is generated automatically from data, controlled via configuration files. Elements such as contact information are managed separately (one single copy of the data) and incorporated into the metadata records.

GeoMet (geospatial web services) serves 90,000 users with 1.8M maps per day. Supports OGC Web Service standards via MapServer: WMS, WFS, WCS and SLD. Data is accessed at request time meaning that products always incorporate the latest data. Data is converted into multiple formats to support user requests. GeoMet 2 scheduled for release in April 2018.

Datamart serves 500GB of [flat file] data to over 500,000 users daily. AMQP protocol is provided for some data so that subscribers can be notified when new data, such as new hurricane tracks, arrives. See: <http://dd.meteo.gc.ca>. AMQP chosen because it was supported by the Federal Government services. Considering implementing OpenDAP in Datamart next year.

**3.1.17/ WHOS and hydrological data sharing,**

Silvano Pecora presented on the WMO Hydrological Observing System (WHOS) and hydrological data sharing (presentation) [[http://wis.wmo.int/tdoc=406](http://wis.wmo.int/tdoc%3D406)]. Please refer to the presentation for details.

Silvano Pecora noted that much of the technology required for WHOS is strongly aligned with those presented previously, and suggested some pilot applications for WIS 2.0 to create real-time products for hazard awareness.

The facilities of WHOS include: catalogues, data access services, modelling (e.g. salt intrusion), notification.

Combining hydrological data with data from other domains (e.g. urban planning, insurance loss from historic events) allows data to be used to minimise societal impacts.

This information is quite difficult to collect - but is essential to use to work out, for example, to determine the payback period for a new drainage scheme in in Genoa.

Ontology and vocabulary management was noted as being inconsistent. In the future, it would be good to automatically assign vocabulary terms based on metadata. That said, many systems do not create “fully compliant” metadata and therefore it is difficult to apply the automated terms. Publishing controlled vocabularies is essential (and publishing controlled vocabularies on the Web, with each term having a unique URL, is a good start to making them reusable) - but not enough. The main issue is one of data management - getting data publishers to describe their data better through capacity building and training: leaving data publishers as free as possible, but providing training and insight to improve. Data must be accompanied by good quality metadata.

Stefano Nativi noted that in a more collaborative “system of systems” with Web-centric data sharing environment, one has to manage diversity of approaches from data publishers. This is a different approach to “fully directed system of systems” (such as EU INSPIRE) and requires a different approach as you cannot impose your standards on the data publishing community.

**3.1.18.**[**GEO / GEOSS and interoperability with WIS**](http://wis.wmo.int/tdoc%3D362)

Stefano Nativi presented on progress towards GEOSS Ecosystem and Platform (presentation) [[http://wis.wmo.int/tdoc=362](http://wis.wmo.int/tdoc%3D362)].

GEOSS has evolved significantly over the last 10-years, with two major evolutions. First from a catalogue of catalogues to a data brokering solution and then to deal with [provision of data through services].

To respond to emerging cloud and Big Data concerns the “GEOSS-Evolve” initiative was started in 2016. It comprises several work packages, being lead by organisations from international community: USGS, ICSU, OGC, China … etc. The new GEOSS evolution is towards an “ecosystem” - well aligned to WIS 2.0.

GEOSS adopts the “supply chain” model: “data is the new oil”. The GEOSS supply chain covers data systems / providers (upstream) through GEO Regional Data Hubs (midstream) to the GEOSS Common Infrastructure, flagships, portals and other applications (downstream). “Datacube” and satellite data analytics (relating to big data services) span from upstream to downstream.

More downstream services were listed in the presentation - including search ranking and analytics of who is using the data (important for data providers to sustain their services by understanding the value of their data to users).

The ecosystem is more than just the technology - it also requires the human aspect: collaboration, capacity building, training etc. Technology is not enough. Which is why the GEOSS Ecosystem is moving toward a collaborative system of system - with the necessary human aspects in place.

See also: <http://www.geodab.net> and <http://www.geoportal.org>

**3.1.19.** [**Interoperability WMO Information System and GEOSS**](http://wis.wmo.int/tdoc%3D403)

Thorsten Büsselberg presented on interoperability between WIS and GEOSS (presenation) [[http://wis.wmo.int/tdoc=403](http://wis.wmo.int/tdoc%3D403)].

WIS metadata is harvested into GEOSS enabling a user of the GEOSS portal can find all the WIS metadata, and (via the GISC Seoul portal) a WIS user can find all the GEOSS metadata.

Thorsten Büsselberg concluded that high-quality metadata is crucial for both WIS and GEOSS.

**3.1.20.** [**Overview of marine data networks**](http://wis.wmo.int/tdoc%3D405)

Patrick Gorringe provided an overview of marine data networks that could be contributors to WIS (presentation) [[http://wis.wmo.int/tdoc=405](http://wis.wmo.int/tdoc%3D405)].

Most centres already have their own metadata catalogues and generally provide Web-based [data] services. But many of these centres are not aware of WIS.

“Data aggregators” (e.g. within Europe there are Copernicus, EMODnet, SeaDataNet etc.) are probably where we should focus our efforts - these aggregators already have collaborative frameworks in place with the data publishers themselves.

Data aggregators are important from an end-user perspective who want a “one stop shop”: the “data jungle” is confusing for all but the most informed users. EMODnet (and others) are designed to collect the confusion of datasets into a single place and provide translation services to make the data more available and, in some cases, provide long-term stewardship of data where the originating centres cannot do this - giving people a safe place to put their data (in a long term archive).

Patrick Gorringe noted that the key approach was to re-use what already exists, rather than trying to build new [networks] or impose new requirements on data publishers.

Data ingestion portals are also  a useful part of the network (see “Wake up your data” from EMODnet [<https://www.youtube.com/embed/p3vwngxyXuo>]).

SeaDataNet is already a part of GEOSS.

Paola De Salvo notes that there is a vast amount of data being collected by these marine networks - much of which is not currently visible through GEOSS or WIS.

**3.1.21.** [**Ocean Data Portal (ODP) - interoperability as a WIS DCPC**](http://wis.wmo.int/tdoc%3D399)

Sergei Belov provided information on the Ocean Data Portal (ODP) from IODE (presentation) [[http://wis.wmo.int/tdoc=399](http://wis.wmo.int/tdoc%3D399)].

International Ocean Data (and Information) Exchange (IODE) facilitates the free and unrestricted exchange of marine data. The Ocean Data Portal has been part of IODE since 2007, undergoing several evolutions during that time. The ODP operates from the National Oceanographic Data Centre of the Russian Federation.

ODP provides an extensive toolkit covering data management, data presentation and [data services]. The ODP framework provides a number of technical features (see presentation) that are well aligned with the techniques and patterns discussed previously: common controlled vocabularies, metadata, multiple data formats, multiple data transfer protocols, OGC Web Services etc.

Each ODP node is able to provide WMO Core Metadata (v1.3) out of the box. So an ODP node can easily function as a DCPC - they comply with the existing WIS Technical Specifications.

There are four ODP nodes: Russia, China, Kenya, Argentina.

ODP submits metadata into the GEOSS system.

# Annex 5: Use Cases as developed in Breakout Groups

## Breakout Group 1

### Use Case 1: NMHS in Developing Country

* Introduce observation to the WIS 2.0 ecosystem
* Run a Local Area Model on defined area – access to infrastructure without having to maintain in hardware
* Use services from NWP centre to prepare products for an end user (e.g. agriculture, aviation).

Assumptions:

* the centre has internet access, either 3G /4G
* the data is correctly described in metadata
* any stations are listed in OSCAR.
1. WIS portal – machine to machine or observer to machine mechanisms.
	1. WIS portal accessible from internet.
	2. Security Authentication/Authorisation/Access functionalities. (Google/FB etc technology)
	3. Data formatting and validation functionality to agreed standards (intelligent platform).
	4. Training and documentation of system
2. Running the LAM (Centre has its own model it wants to run remotely)
	1. Provision of a virtual machine on a remote platform (IAAS).
	2. Accounting system for user costs.
	3. Require the underlying model for boundary conditions from any global centre.
	4. Service offered by global NWP centres – supply the underlying model for boundary conditions.
	5. Training and documentation of system
3. Running the LAM (Centre has no model)
	1. Provision of a model machine on a remote platform (SAAS).
	2. Accounting system to ensure NMHS stays within agreed computer resourcing.
	3. Require the underlying model for boundary conditions from any global centre.
	4. Service offered by global NWP centres – supply the underlying model for boundary conditions.
	5. Training and documentation of system
4. Using Global Model to prepare new services.
	1. Access to visualisation tools for view model products.
	2. Authentication/Authorisation/Access functionalities required for such a service.
	3. Delivery service to send products/service to ‘end user’.

### Use Case 2: NWP Centre

* Wants to run a High Res Global Model with a grid less than 5km
* Need to get all in-situ observation in real time (5’ or 1’ temporal resolution).
* Need to get all radar data in real time; getting all raw data is too big
* Provide services on NWP output.
1. In-situ observation acquisition.
	1. System to subscribe to all Observations within WIS 2.0, in a ‘twitter-like’ manner.
	2. System needs Authorisation, Access, Authentication for the publisher and accounting system, so the publishers know who is consuming their data.
2. Radar data acquisition.
	1. The radar data owner to run pre-defined extraction service for NWP centre.
	2. The Radar data consumer to run pre-defined service within the radar data centre environment, and export the subset of data required for modelling.
	3. Requires notification, distribution, accounting, authentication services.
	4. Change management for new/ closed observation sites (OSCAR).
3. Provide services on NWP output.
	1. Post-processing toolbox:  Sub-setting of data – extraction, slicing and dicing of model data. Data cubes. Downscaling and interpolation. (includes Boundary data for LAM centres).
	2. Workflow management system and notification service.
	3. Classic set of web services (WCS, WFS etc) for machine and human consumers.
	4. Visualisation tools for human consumption.
	5. Data repository for model users to retrieve model.

### Use Case 3: NMHS MeteoAlarm Service

* NMHS wants to send a notification alarm to a smartphone when a threshold is/ will be reached.

Assumptions:

* Cell broadcast service is not enabled in the country, and notifications are only sent to registered users.
1. CAP implemented to provide the WIS compliant MeteoAlarm system.
2. Criteria, geographic zone, event type, and thresholds are either predefined, or user defined.
3. Visualisation system to map the area of alarms.
4. Push notifications system such as Microsoft Azure or Google / iOS Cloud Messaging Services.
5. User registration system, perhaps through a partnership with a national civil protection organisation.

### Use Case 4: Global insurance company

* Developing new product
* Needs to run a study on a reanalysis data from different climate centres
* Getting all reanalysis data is too big to move.
1. A unified interface to discover climate centres around the world.
2. Compute facility close to the data the insurer can use to run its own software on.
3. Unified toolbox for analysis and sub-setting of data at each CC.
4. Authorisation, Access, Authentication system and an accounting system, so the insurer can be charged.
5. Visualisation and Delivery mechanisms check/send to send results to company.

## Breakout Group 2

### Use Case 3: NMHS MeteoAlarm Service

* NMHS discovers NWP and/or observation services related to the location of their users (possibly with interpolation services) The NMHS is a producer of products (i.e. alarms)
* NMHS describes one or more triggers (e.g. parameter exceeding threshold) and register it through the WIS at data producers, together with an action to be performed (e.g. send an SMS with a customized message, push to phone app, etc.)

Requirement 1: WIS supports workflow and/or orchestration of event based services

Requirement 2: WIS supports notifications

### Use Case 4: Global insurance company

* Performing computation next to the data
* Perform the same computation at different data provider

Requirement 1: relevant data sources and services are easily discoverable (also which are the most appropriate for your purpose, good metadata, ontology,…)

Requirement 2: data provider offers processing next to the data

Requirement 3: data provider offers the same processing tools

Requirement 4: data provider offers the same (similar) access (APIs)

Requirement 5: business model (cost recovery)

### Use Case 5: Use case economic analysis of flood impact

* User wants to combine to combine data/information from the WIS with other sources

Requirement 1: Discover what data and services are available (!)

Requirement 2: Upload own data (temporarily) to be used by processing facilities in the WIS (e.g. when combining with large NWP output) – Many issues: who pays, what about abuses, need for sandboxes, etc. May require support of commercial cloud provider (c.f. Met Office use of Amazon Web Services).

Requirement 3: The WIS offers services to download “just” what is needed (e.g. point forecast), then combine on own computer.

### Use Case 6: UN spatial analyst preparing a food security assessment

* Person does not know that WIS exists (and work)
* May not have access to proper ICT infrastructure (e.g. deployed into a field office in Ethiopia)
* Need to combine (possibly large datasets) from several  sources

Requirement 0 Starting from Google/Bing, as user must eventually reach WIS portals/catalogues

Requirement 1: Discover what data and services are available (!)

Requirement 2: Discover also that there maybe more relevant dataset available in the WIS (not simply rainfall, e.g. agriculture related products)

Requirement 3: WIS provides tutorials, training material, etc.

Requirement 4: WIS is simple to use

Requirement 5: All WIS services are available via the World Wide Web

Requirement 6: WIS offers cloud-based facilities that allow combining of large dataset while minimising data transfers (especially on poor lines)

Requirement 7: See UC5

## Breakout Group 3

### Use Case 1: NMHS in Developing Country

* Introduce observation in WIS 2.0 eco-system
* Run a LAM on defined area – access to infrastructure without having to maintain the infra
* Use services from NWP Centre to prepare a product for end user (agriculture , aero)
1. Services
	1. WIS 2.0 [defines] a policy framework that allows services to be used together as opposed to WIS 1.0 which is an infrastructure and is limited
	2. WIS 2.0 needs to provide an attractive methodology for others to contribute their services – because this use case implies that someone has to pay the bill to operate these hosted services
	3. WIS 2.0 to approach and encourage others to contribute their services
2. Technical
	1. WIS 2.0 does not need to specify all of the technical details – contributors will determine how best to build & operate their services; WIS 2.0 needs to determine how to make contributor’s services easy to use together
	2. Data exchange, Data contribution
		1. Inclusive – what is the cost of adding a new centre or service? Data for free, management service
		2. Need to enable data be provided in a timely manner – standards, technology/infrastructure, …
	3. Access to provisioned environments (flexible - research and more static - operational)
	4. Governance and General terms of use for service(s)
		1. Appreciate the different types of users (different capabilities) and differences between public and commercial usage
	5. Tools
		1. Availability of general tools and possibility to integrate local tools
		2. Discussion on ownership, IPR of algorithms, products
	6. Establish open framework for enabling access to WIS members
3. Policy Framework
	1. Data, output, services - use in public and commercial scenarios
	2. User does not need to know where resources and services are provisioned
	3. WIS 2.0 to allow services to be exploited by a wider community

#### Key points and issues (based on mind-map [[PNG](http://wis.wmo.int/tdoc%3D414), [XMIND](http://wis.wmo.int/tdoc%3D417)]):

WIS 2.0 service onboarding process

* Intake
* Requirements Analysis
* Design
* Provision
* Build
* Connect
* Ingest/Harvest
* Integrate
* Test/Verify
* Describe
* Engagement and outreach

Key Functions

* Solution Design
	+ Workflow
* Infrastructure
	+ Infrastructure Hosting
		- Full 'VM'
		- Custom hardware
	+ Infrastructure Development
		- Telecommunication (Bandwidth, Coverage) - Site to Site
		- Telecommunication (Bandwidth, Coverage) - Device to Site
	+ Infrastructure Integration
		- Collaboration Network (Configuration - e.g. Virtual Network)
* Data
	+ Data Hosting
		- Data submission to existing repositories
		- Development of new repositories
	+ Data Exchange
		- Data Upload
		- Data Download
	+ Data Access
		- Service access
			* Open Access
			* Protected (Originators only)
			* Protected (Project team only)
		- WAF
			* Open Access
			* Protected (Originators only)
			* Protected (Project team only)
* Services
	+ Service Hosting
		- Data service
			* Access service
			* Edit service
		- Analytical service
		- Transformation/processing service
	+ Service Development
		- Data service
			* Access service
			* Edit service
		- Analytical service
		- Transformation/processing service
	+ Service Integration
		- Integration of external services
			* Open Access
			* Protected (Originators only)
			* Protected (Project team only)
* Products
	+ Product Hosting
		- Product onboarding - 'simple' processing
		- Product onboarding - 'advanced' (VM) processing
	+ Product Development
		- New product
		- Extension/modification of existing product
	+ Product Access
		- Service access
			* Open Access
			* Protected (Originators only)
			* Protected (Project team only)
		- Interactive
			* Open Access
			* Protected (Originators only)
			* Protected (Project team only)
* Applications
	+ Application/Tool Hosting
		- Local standalone tool
		- Hosted standalone tool
		- Service as a tool
		- Thematic portal
	+ Application/Tool Development
		- Local standalone tool
		- Hosted standalone tool
		- Service as a tool
		- Thematic portal
	+ Application/Tool Access
* Catalogues and search
	+ Data/Product/Application/Service Cataloguing
		- Metadata development
		- Metadata ingestion
		- Metadata publication
	+ Search Optimization - 'General'
		- Commercial search engines
		- WMO and partner catalogues
		- Metadata brokers/data aggregators
	+ Search Optimization - Directed (on request of individual, region, or program)
	+ Search Optimization - Responsive (based on catalogue/data usage, monitoring data)
* Training
	+ WMO hosted services
	+ Data management best practices
	+ Metadata production and search
* Quality of Service
	+ Infrastructure
	+ Data
	+ Services
	+ Products
	+ Applications
	+ Training
* Audit and Certification

Internal Services

* Policies
* Budget Management
* Project Management
* Service Agreement Management

Client Use Cases

* Use Case - Remote Centre with requirements for: network link + data hosting + hosted processing + data exchange + product hosting + product access (open) + service hosting + service access (open) + search engine optimization (open search + directed search)

Implementation Strategy

* Initial Phase - Mostly individualized service, some leveraging of complementary services/capabilities
* Evolution Phase - Introduction of new managed (via tech. spec) services, elimination of some individualized services, increased use of complementary services
* Operational Phase - More new managed services, elimination of more individualized services, increased use of complementary services, introduction of WIS processes to integrate new services as WIS tech spec.

#### Further discussion on Use Case 1 (based on flipchart [http://wis.wmo.int/tdoc=412]):

Use Case 1 focuses on a NMHS from a developing country wanting to operate a Local Area Model (LAM) and provide services to their citizens based on the output.

Our assumptions are:

1. there is limited availability of local ICT infrastructure
2. the Global Model output (required for boundary conditions of the LAM) is too large to move in the necessary timescales required for operational forecast services

Three distinct mechanisms may be available for running the LAM:

1. Research mode- model development, model configuration
	1. LAM is a software entity plus configuration
	2. May need additional libraries etc. to support model development - increased flexibility increases security risk
	3. Provision a virtual host with “LAN-speed” access to the data on non-business critical infrastructure
2. Operational mode
	1. LAM is a software entity subject to managed release cycle, plus configuration
	2. LAM software is verified off-line; security risks are known
	3. Provision a virtual host with “LAN-speed” access to the data based on predefined machine image and/or container - for example, NCAR have already containerised the WRF model [<https://www.mmm.ucar.edu/weather-research-and-forecasting-model>] to allow for convenient deployment and reuse (see NCAR DOCKER-WRF)[<https://ral.ucar.edu/projects/ncar-docker-wrf>]
	4. Managed security risks suggest that the LAM could be run on business-critical infrastructure for improved service level
3. Reusable service
	1. LAM is used by multiple agencies
	2. LAM packaged up as a Service within the Cloud-environment that can be executed as necessary (see “toolbox” below); management of LAM configuration is part of service

Modes (1) and (2) are similar to the Copernicus DIAS service being developed by EUMETSAT, ECMWF and Mercator Ocean. We noted that in DIAS, jobs are run at one of four locations- but the users do not know, or need to know, which specific location is used for their job.

How local / national observations get into the cloud-environment was not discussed. However, we noted that these observations may be subject to restricted data policies (e.g. if sourced from a commercial provider those observations may only be applicable for use in specified applications).

The cloud-environment may also provide a “toolbox” for users (similar to that provided by the Copernicus Climate Data Store being developed by ECMWF and co.) - packaged services that can be chained together into workflows to process data into products, visualisations and Web/mobile applications.

Looking at this use case, it seems clear that (almost) any Web-based technologies will fit with WIS 2.0; the key is packing these contributions as usable services. WIS 2.0 needs to provide a framework that enables organisations to contribute their services.

Governance issues associated with hosted processing include:

* Who pays (e.g. Development Banks may cover the costs of developing nations); what is the funding model (e.g. in Copernicus, the EU pays for services to provided to a specified user community under certain conditions); cost recovery; is the service part of core business (e.g. as a designated WMO centre); revenue opportunities - without clarify on funding model(s) services will not be sustainable.
* Who can access/use
* Performance and service level agreements
* Data policy & licensing; who owns the output of the LAM when executed on the hosted infrastructure; who owns the LAM configuration; who owns the software license for the workflows executed in the toolbox; how would the data policy for observations used in the LAM be respected? Note that GEOSS “respectfully nudges contributors toward open data policies” but does not demand them.
* How do the services provided in this cloud-environment become part of WIS? WIS 2.0 needs to be inclusive; allowing a breadth of services to registered. We need to be clear how new services are incorporated into WIS, including determining the cost to candidate centres (e.g. centre certification/accreditation, adoption of open data policies etc.)

These issues should be addressed by the WIS 2.0 “policy framework”.

A key question to consider regarding WIS 2.0 is why would agencies contribute their services? We can learn from GEO: people join GEOSS because it provides services (and data) that are useful to them - and the cost of joining is contribution in kind of their data and services. This WIS 2.0 policy framework should encourage service providers to register services in WIS because it is beneficial to do so. Should WMO be proactive in encouraging other organisations to contribute services, for example, how should WMO approach the European Commission regarding services for Copernicus?

Another key question to consider is how WIS 2.0 should treat commercial service providers (e.g. cloud-service providers such as AWS, Alibaba)? Should they be treated any differently? Should their services be subject to the same “free and open data exchange” policies as are typically used by government agencies?

### Use Case 6: UN spatial analyst preparing a food security assessment

* UN GIS analyst (official duty use – not commercial, individual)
* Want to access rainfall datasets through data catalogue and/or common (commercial?) search engine
* Need to be associated with other datasets (land, population distribution, …)
* Produce food security (food shortage projection) product

Assumptions:

* This use case addresses issues that are not of a real-time nature.
1. Discovery
	1. WIS can provide improvements in terms of discover
	2. Technical requirements
	3. Two types of service offerings
		1. Directed search - Specific index/search based on known issue
		2. Monitoring-analyzing trends in data request/use; Implies active management of list of issues with the community & identification of recurring issues-based searches
	4. Open versus Trusted search
		1. In both open and trusted, the context/owner of the data is maintained
		2. In Trusted, result set is limited to resources of known quality or authority – WMO acts as authority?
	5. WMO to coordinate the implementation of targeted, issues-based searches with commercial search providers
	6. Includes assembly of data, metadata, unstructured data across the contributing community for indexing
	7. Individual data and information producers do not need to have the full picture – WMO identifies relevant resources/search criteria with search engine provider
	8. May include metadata enrichment, registering site indexing with search providers
	9. Potentially implement trusted searches as well (e.g. value-added service provided by providers)
	10. Timeliness of service, currency of results – high degree of currency will cost…
	11. WIS may want to work with private sector to provide complementary services.
	12. WIS would want to work domain experts to identify essential variables/products to support directed searches, harvesting.
	13. Enhancements to the technical spec: contract required to support a web crawler – doing this indexes content for non0directed and directed searches
	14. HTML, sitemap, schema.org,…
	15. Connect with W3C community standards
	16. WIS should offer a complementary response in terms of search results instead of subsets
	17. User searches for product A consisting of components A.1, A.2, A.3. WIS should provide a comprehensive response for all components A.1, A.2, A.3
	18. Pre-conditions to fulfilling this use case would include WIS 2.0 identifying the relevant variables, data sources, and initiating the indexing of that data.
2. Access
	1. WIS can be very constrained in terms of how it may improve access…
	2. This use case needs to be implemented in a way that does not violate individual policies
	3. It is currently possible to enable discovery of data, obtain a URL, and be redirected to a login page where data is not open
	4. \*\* Issue – handling authentication issues and striving toward seamless access..

#### Further discussion on Use Case 6:

Use Case 6 describes an expert user, in this case a Spatial Analyst named Paola who is employed by the United Nations, searching for information pertinent to a food security assessment.

Paola is interested only in authoritative data from trusted sources. She might have developed her own list of trusted information sources, but this is fragile as newly added datasets from new sources would not be visible to her (i.e. they are not on her list). Instead, we want to provide Paola with a “directed search portal” where authoritative and trustworthy sources of information for a specific topic have been pre-selected.

For example, in the Global Ocean Observing System (GOOS) Essential Climate Variables (ECVs) are linked with the types of decisions they support. Thematic portals are provided for particular topics that search only that data sources providing pertinent ECVs.

The creation of these “pathfinders” for specific issues is common practice within the library community.

Part of the process for building directed search is working with the user communities to configure search in support of typical issues or themes. In the case of Paola, she is interested in food security, so would need data relating to seasonal precipitation forecasts, land-use, population demographics etc.

Such a “directed search” may be considered as a service that can be registered within WIS 2.0.

It is clear that WIS 2.0 will need a catalogue to provide a list of WMO resources (authoritative services and data). However, it appears unnecessary to continue maintaining 15-synchronised catalogues at each GISC.

The GEOSS Common Infrastructure supports “directed search” by “subsetting” the GEOSS content and presenting that subset through a thematic search portal. Using this mechanism information from multiple domains can be collated to answer those priority issues - the search need not be only restricted to hydrometeorology.

An alternative approach would be to engage commercial search engines to provide the directed search service, specifying which sources should be included in a closed/controlled index of resources - ensuring that only ‘authoritative’ content is included. Such a directed search service may be ‘white-labelled’ so that the user is unaware that the search is offered by a commercial provider. Using this approach, the data provider can have their content indexed using the same method for both “open” and “directed” search, and in doing so, also make their data available to (non-expert) users who are unaware of the directed search portal. Furthermore, a commercial search engine will also be able to provide sophisticated metrics and analytics about who is searching for what, providing insight that enables data providers to better improve their offer (e.g. search engine optimisation). Commercial search engines typically use Web crawlers to find and index HTML pages, directed by sitemaps where available. Commercial search engines are increasingly using structured mark-up (e.g. JSON script elements using the [schema.org](http://schema.org) vocabulary) within the HTML content to help improve the quality of search.

A government agency, such as an NMHS, may decide to contract directed search services to a commercial provider. However, WIS 2.0 should also support the case where a commercial search engine provides directed search on their own behalf - for commercial or philanthropic reasons. WIS 2.0 should enable the inclusion of *complementary* services provided directly by the private sector. As with any service, whether offered by public or private sector, the contractual agreement for provision of the service must be clear.

Whether GEOSS subsets or commercial search engines are used to provide directed search, the efficacy of discovery is entirely dependent on data/service providers creating “good” metadata. Furthermore, as metadata will often be reformatted when the information contained therein is presented to the user, there should be a clear pathway for a user to find the original metadata from the data publisher which may contain additional information not presented to the user via the search portal.

It was also noted that directed search services (and data catalogues in general) should provide metadata about their own services, e.g. what domains they cover, who they harvest from etc. Publication of vocabulary cross-walks (e.g. mappings between controlled vocabularies) will also help users find things that might use different, but related, terminology.

As a final note to Use Case 6 we look at access to the data itself. Once Paola finds the data necessary for her analysis, she will need to download the data (or work with it in situ). Data policies, even those for data available under open licenses, often require a user to register to access the data, e.g. to track the usage and understand the impact of the data, or to notify users when the dataset is updated. User management and authentication will be defined by the data/service provider. We recognise that use of federated user management, such as EduGAIN / EduROAM for research users, simplifies registration for the user as the same credentials may be applied within many services - but this is not essential. If federated user management is employed, once again, the data provider will determine which identity providers they trust. For example, they may choose to accept credentials from Google, Facebook, Microsoft etc. like many currently available Web applications and services.

# Annex 6: Participants comments on day 3 “where are we & what have learned or decided”

At the beginning of day 3, participants were asked to summarise their thoughts about WIS 2.0; what they have learned and what TT-eWIS has decided during the discussions.

**Paola De Salvo**

WIS 2.0 should work on content pertinent to WMO

There are many interesting solutions already in place - these should be the basis of the [infrastructure] from which WIS 2.0 could be comprise

GEO are happy to complement and contribute to this outcome - and can support WIS 2.0 in meeting your needs

To strengthen the update from data providers, need to minimise the effort to contribute

To strengthen the update from data users, need to link metadata with the data itself

**Luo Bing**

WIS 2.0 needs to encourage Members to provide more useful services

**Steve Foreman**

WIS 2.0 should make it easier for users to find the information and knowledge they \_need\_

And allow users to create added value for their community through use of services

**Lothar Wolf**

[All participants of TT-eWIS] share the same values and objectives - different to our starting point of 15-years ago

Legacy and heritage [such as reliance on the GTS] is still an issue today - that we must overcome

Risk to overload discussions - need to be cautious to capture our top 4-level objectives very clearly

**Kevin Alder**

We know our technology - but it remains essential to undertake outreach

Our legacy (where we’ve been) clouds perspective our future - so we need to be more careful

Measure of success will be the engagement of WMO community - and wider groups

We must not only focus on technology - discussions about policy (relating to UC1) demonstrate the diversity of opinions about an apparently simple subject

**Peiliang Shi**

We are focusing on the user needs (both data/service providers and consumers) now - before we were focusing on infrastructure

We now have a diversified group working here - much more so than before

We need to be clear on the top-5 priorities - we can’t be exhaustive

**Silvano Pecora**

For CHy these are initial steps into WIGOS and WIS - for you, this is the evolution but for hydrology this is the beginning

There is good alignment between WIS 2.0 thinking and the needs of the hydrological community

We discussed about data, metadata, products etc. - CHy is working on these

In June 2018 CHy will submit the first document about WHOS (phase 2) - confident that this will be well aligned with WIS 2.0

**José Mauro Rezende**

GTS needs to be replaced

We think of users

We don’t reinvent the wheel - we can be more lazy

**Jan Osusky**

WIS 2.0 is not about prototypes and bleeding edge - it’s about connecting existing components

We don’t need to wait for all data providers to use modern services - we will be inclusive using brokers etc. to get there content included and create a completely global information sharing environment

Not clear about directed search yet - will we cherry pick authoritative sources?

**Jeremy Tandy**

WIS 2.0 must be a collaborative system of systems - turning things on their head from a directed system of systems where we say how people must contribute, to a regime where we make it easy to contribute

There are plenty of technical solutions and services out there

The ocean community has done much already

We have much work to do on the policy side to enable contribution of services

GEOSS seems like an excellent place to start - technology and outreach

We will need additional services (not already available) - e.g. for realtime data exchange

**Matteo Dell’Acqua**

Technical solutions presented about cloud indicate that the future is not as scary as it seemed - we know how to do this

Impressed with the work of marine and hydrological communities

Impressed with GEOSS - it is what WIS aspires to be

**Baudouin Raoult**

Sees that we are all going in the same direction

**Rabia Merrouchi**

Very confident that the vision of WIS 2.0 will release [productivity] and support the needs of WMO programmes

Use cases look simple - but they cover the most urgent needs of WMO Members; and these remind the Task Team about where we should focus

We are on the correct path

**Sergei Belov**

WIS should be more visible - both to public and private sector

WIS must be an evolution not a revolution - WIS 2.0 must sustain existing communities

We have a really great task team - we can do this job

**Jacob Tomlinson**

GEOSS shows the path forward

Everyone is already investing and building systems and services to deliver their own business outcomes

Capturing these services will make WIS 2.0 sustainable - because people have the long-term investment/funding in place

**Tobias Spears**

More similarities than differences; the move to being more collaborative is good

Service oriented approach provides a model for growth into the future

Need to appreciate the state of the centres/services - break down the technical and other barriers to enable participation

The discussions resonate with the marine community needs

**Thorsten Büsselberg**

GTS needs to be replaced - but we want WIS 2.0 to be as successful as GTS

TT-eWIS discussions mirror those from GEOSS over the last years

The use cases are very helpful in articulating our requirements

**Erwan Favennec**

We should use and be inspired by what already exists

We should leverage externally sourced tools, such as commercial search engines, to be effective

Start from the user needs - this is what made the use case activity very useful

**Shuichi Ikeda**

Before this meeting, the requirement was very abstract - now I understand

**Patrick Gorringe**

Learned that WIS wants to change - and this makes me happy; I can now talk about WIS in the marine community

WIS 2.0 has a very good start level by leveraging existing initiatives

Work with aggregators to promote the benefits of WIS 2.0 and to help with the training

GEOSS progress is impressive - want to work more with them

**Kate Roberts**

Metadata quality is a key issue - the tension between making the barrier of entry low vs. having useful metadata has negatively impacted search performance

Surprised to hear about problems with XML metadata - I have always used tools that abstract away from the XML

**Alex Leroux**

Now have a much better understanding about WIS 2.0

Lots of work ahead!

1. noting that service resilience and performance must be considered in design of such a service [↑](#footnote-ref-1)