Workshop on Future Directions of GAW Data Management
10-11 August 2015, Meteo Swiss, Zurich Airport, Switzerland

Participants

Jörg Klausen, Meteo Swiss
Greg Carmichael, University of Iowa
Oksana Tarasova, WMO
Tony Colavecchia, Environment Canada (World Ozone and UV Radiation Data Centre)
Hiroshi Koide, Japan Meteorological Agency (World Data Centre for Greenhouse Gases)
Markus Fiebig, NILU (World Data Centre for Aerosols)
Silvina Carou, WMO
Anatoly Tsvetkov, Roshydromet (World Data Centre for Radiation)
Julian Meyer-Arnek, DLR (World Data Centres for Remote Sensing of the Atmosphere)
David Thomas, WMO
Terry Keating, US EPA
Kjetil Tørseth, NILU
Martin Schultz, FZ Jülich
Ellsworth Judd Welton, NASA
Gelsomina Pappalardo, CNR/IMA
Nick Schutgens, University of Oxford, Atmospheric, Oceanic and Planetary Physics, Clarendon Laboratory, UK
Misha Krassovski, CDIAC
Keiichi Sato, ACAP
Wendy Garland, British Atmospheric Data Centre
Andres Becker, DWD
Christian Plass-Dülmer, DWD
Damien Boulanger, CNRS-IAGOS
Jochen Dibbern, DWD
Matteo dell'Acqua, Météo France
Sandro Fuzzi, Istituto di Scienze dell'Atmosfera e del Clima
Casper Labuschagne, SAWS
Martin Steinbacher, EMPA
Frank Dentener, JRC Ispra
Sarah Wong, Environment Canada
Fang Shuangxi, CMA

Background

Observational data collected in support of the GAW Programme are archived by six designated GAW World Data Centres (WDCs), but also and increasingly so, by the data centres serving national and international projects and initiatives, and observational networks. The GAW Station Information System (GAWSIS) serves as an archive of the metadata and a portal linked to the data centres in the GAW Programme. GAWSIS constitutes one of the elements the WMO Integrated Global Observing System (WIGOS) and its analysis and review tool (OSCAR), a platform for documentation of all space- and surface-based meteorological and climatological observing systems world-wide. The evolution of the GAW scope to deliver more products and services requires a review of the data archiving and dissemination system supporting the program, particularly given the increasing need for near-real-time data. Also, new developments in information and communication technologies and emerging metadata standards enable better integration and interoperability of systems in support of better services to users. In order to discuss these new opportunities, experts in the field of atmospheric composition monitoring and services for climate, chemical weather and health were brought together in this 2-day workshop to achieve the following objectives:

1) To scope out a vision for how to manage GAW data, related data and potential service delivery;

2) To review the organizational structure needed to best support GAW data management and to define Terms of Reference of the Data Centres;
3) To guide the update of the Terms of Reference for existing GAW WDCs as well as other data centers that are to be affiliated with GAW.

Workshop report

1. Introduction

Greg Carmichael (Chair of Environmental Pollution and Atmospheric Chemistry Scientific Steering Committee –EPAC SSC) gave an overview presentation of the GAW Programme, including its mission and future strategic direction. The presentation highlighted GAW's role in helping WMO members and society develop and deliver improved products and services involving atmospheric composition. The focus of GAW's new Implementation Plan on services provides a framework via priority application areas to evolve observations and to enhance modeling elements. One priority application area is the expansion of GAW's role in enhancing predictive capabilities with respect to atmospheric composition and its uses. Future needs of GAW include continuing to improve the atmospheric composition observing system and data management (using Rolling Review of Requirements (RRR) process and WIGOS/WIS) to support growing services (e.g., near real-time provision of GAW data, integrate datasets from different platforms to provide a unified understanding of aerosol and gas distributions, minimize gaps in the measurement networks in data-poor regions, and support the expanding service needs related to cities, high impact weather, and climate).

2. Presentations on services provided by GAW WDCs and other archives/data bases

The first day of the workshop consisted of presentations on all six GAW World Data Centres (WOUDC, WDCGG, WDCA, WDCPC, WRDC, WDC-RSAT), GAWSIS and WIS, and other networks and data centres associated and not associated with GAW, including HTAP, USEPA, EMEP, TOAR, MPLNet and AERONET, EARLINET, AEROCOM, CDIAC, EANET, BADC, Global Precipitation and Climatology Centre, ACTRIS, and IAGOS. Presenters were provided with a set of questions in advance of the workshop on which to focus their presentation.

Presentations from the managers of the six WDCs showed there are similarities and differences in how data are received, handled and shared by each WDC. Among the various services provided by the WDCs are data archiving of GAW data, data summaries of GAW and non-GAW data, live downloads from other data centres, discovery metadata, and in the case of the WDC-RSAT, R&D activity results, and services including one-stop-shop for aerosols and ozone information. WDC services are currently tailored to the need of their scientific users. They all provide metadata but in a variety of formats. They house long-term data records and follow different QC procedures. Graphs, maps, summaries and report are in a non-standard output. Some WDCs track downloads others only visits. WDCs implement the GAW data sharing policy (free access to data for non-commercial use), with adjustments in some cases to accommodate data sharing policies of data providers (e.g., mandatory vs. non-mandatory online registration).

GAWSIS is one of the contributors to the WIGOS (WMO Integrated Global Observing System) analysis and review tool OSCAR, a platform for documentation of all space- and surface-based meteorological and climatological and related environmental observing systems world-wide. OSCAR and the WIGOS RRR process help analyze and improve observing systems. GAWSIS feeds OSCAR with metadata from various data archives including several GAW WDCs, NDACC, EMEP (and is set up to support more centres). A new version of GAWSIS and OSCAR will be operationalized later this year. Participants were encouraged to sign up for beta testing of the system. GAWSIS/OSCAR implements the WIGOS/WIS discovery metadata standards which are ISO 19115 compliant. Interoperability of systems and appropriate data description are keys to adequate use of observations, network analysis and planning. WIS (WMO Information System) metadata provides a way to find and exchange observational data and derived products. WIS includes original, repackaged and redistributed data provided by National Centres (NCs) and the

Data Collection or Production Centres (DCPCs) (e.g., such as GAWSIS). Data providers set the WIS data policy. WIS metadata are also discoverable via GEOSS.

There are more than 15 data archives working with atmospheric composition data and they have more than 20 ways to submit data and different data policies.

Services provided by other networks and data archives include archival, visualization and dissemination of specialized data sets of atmospheric composition observations from selected networks and/or modeling results tailored to specific client communities. Some give access to primary data while others re-distribute data (including derived products) for a large number of parameters depending on the specific objective of each data centre. Data providers and user communities also varied with the predominant user being the scientific community. Some data centres obtain data on a regular basis and some on an ad-hoc basis. Some implement standard metadata formats while others are flexible to what makes sense for the data provider or a combination of the two. All data centres provide open data access (i.e, at no cost to the user) but rules around data use differ from acknowledging the data source to offering co-authorship to the PI and from voluntary to mandatory registration. The majority of the data centres hold long-term data sets and are fairly sustainable. Most were aware of GAW and its data management structures but only few are currently collaborators.

U.S. EPA networks (AirNowTech, EPA Air Quality System) and the TF-HTAP Data Network are sources of primary observational data or in the case of the latter, modeling data. Federal, State, Tribal, and local air quality management organizations are among data providers and users of air quality information form the U.S. EPA networks. Users also include air quality and health/epidemiology researchers, regulated industry, and civil society. Providers and users of TF-HTAP are primarily researchers participating in the TF HTAP interested in model evaluation and secondary observational data from providers with open access policies. Data are submitted routinely and/or ad-hoc in formats based on specific requirements. Data are available to registered users for visualization and download as well as via an interactive user interface.

GAW needs to be flexible and recognize the developments, objectives, and investments of other networks. GAW needs to articulate its role in global air quality data management and its relationship to programs at UNEP, WHO, and national governments. WHO in particular proposed a Global Platform on Air Quality and Health and will deliver a road-map by May 2016. UNEP works toward development of the road map on Air Pollution in response to the resolution of United Nations Environmental Assembly (UNEA) in 2014. This document is to be delivered and discussed in UNEA in 2016. It would be highly beneficial for GAW to join efforts with WHO and UNEP on air pollution. GAW should identify, implement, and advocate for best practices in data interoperability.

Comment [OT1]: We have to ask Carlos to inform us on progress during SSC

Comment [OT2]: Follow up with Valentin , we contacted Jacqueline concerning this document

The EMEP Chemical Coordinating Centre (CCC) coordinates monitoring activities and archives, disseminates, performs QA/QC and assesses primary observational data and associated metadata for nearly all atmospheric composition variables performed within the EMEP programme. CCC serves as a primary data archive. Data providers and/or users include National environmental agencies, Hydromet Services and research institutions. CCC support the Convention on Long-Range Air Pollution and the primary user community is policy makers. CCC provides observational data, while tailored data products are delivered only for specific projects. Data policy defined by the client but EMEP/GAW open data policy is encouraged. Proper data management is very resource demanding.

Issue: CCC serves as a primary archive for EMEP stations many of those are also GAW stations. CCC shares the archiving platform with WDCA (Ebas). This leads to the submission of reactive gases data to both Ebas and WDCGG. Effort is needed to avoid duplication of data from “contributing networks” to WDCs (on 1 January 2016 a new GAW Data Centre for Reactive Gases was established in NILU that uses Ebas system as well to address this issue).

TOAR (Tropospheric Ozone Assessment Report) is an IGAC funded project which has its own database to distribute value added products, and visualization and statistical tools for various user communities. It does not impose specific requirements on data submission formats. For

access to raw data, users are directed to original data provider. TOAR has close contact with GAW data screening, data downloads, metadata screening, metadata definition (through Task Team on Atmospheric Composition Vocabulary).

NASA's MPLNET and AERONET are worldwide networks of lidars and sun/sky photometers, respectively. Both networks collect observational data, and distribute both primary observational data (NRT data) and derived data. MPLNET Lidars and AERONET sunphotometers utilize specific raw data file formats and data from instruments are collected via automated, standard data communications and processing. Both networks follow NASA's open data policy requiring offer of co-authorship to project and site PI. MPLNET is a contributing network to GAW/GALION but not yet registered in GAWSIS. Challenges exist to incorporate lidar data from networks to WDCs (e.g., WDCs could not QA/QC nor customize data the way networks can).

EARLINET (European Aerosol Research Lidar Network) is a comprehensive, quantitative, and statistically significant data base of long-term aerosol Lidar observations at the continental scale. Lidars used are developed by EARLINET (not commercially available) and collected raw data are only used for QC and testing of instruments as well as to produce derived products (raw data not disseminated). Data providers are the EARLINET stations PIs and users include mainly the scientific community, as well as agencies (space, air quality, air traffic control, climate, etc.). All data are uploaded to the central database within three months after measurement in a standardized format. Only QCd and derived data with DOI are accessible to the public via a centralized data base. EARLINET, part of GALION and operated within ACTRIS, is a contributor to GAW (registered in GAWSIS). EARLINET works with SDS-WAS for data/model exchange.

The AeroCom database houses primary and secondary modelling data and secondary observational data (the latter only used for quick visualisation of model performance) of various parameters (AOT, PM, mixing ratios, ozone). Only benchmark datasets and modeled data are distributed. Data providers include modeling teams around the world and various datacenters (Aeronet, EBAS, EMEP, EARLINET, ACTRIS, WDCA, NOAA, satellite archives NASA, ICARE, ESA) who follow defined data requirements. User community is mainly scientists interested in aerosol climate interactions, air quality, model comparison and evaluation. Modeling data sharing policy requires proper referencing and offer of co-authorship in some cases. Usage of observational datasets require consent from the respective data authors prior to use/publication.

CDIAC (Carbon Dioxide Information Analysis Center) archives ~ 1500 databases/datasets of CO_2 and other GHG data from multiple agencies and from multiple media (atmospheric concentrations and emissions, land, oceans and climate). Some data are primary and some secondary. CDIAC distributes observational data as well as derived products, though it had not much success with model data sharing. Data providers include U.S. Department of Energy sponsored projects, National and International data networks, universities, primary investigators/scientists Data heavily downloaded (11000 downloads of CO_2 products in 2014) by worldwide users, scientific climate community, academic and educational institutions, private companies, government agencies, mass media, independent scholars, etc. Data submission guidelines strive for standards-compliant (e.g., ISO 19115) metadata but not rigidly enforced. CDIAC offers QA/QC of the submitted data and develops derived products. Data access is free with sharing policies varying by project and set by project PIs.

EANET (Acid Deposition Monitoring Network in East Asia, established in 2000) collects and distributes observational data of wet and dry deposition, soil, inland aquatic ecosystems, and meteorological parameters. Modeling is implemented as a research activity. Data providers are the Network Center for EANET and the 13 EANET participating countries (45 stations). Users are atmospheric scientists mainly in East Asia and others in US and Europe for research purposes as well as local and national policy makers. Data disclosure is based on EANET's data and information disclosure policy. Database is maintained and managed by the Asia Center for Air Pollution Research and funded by EANET participating countries. EANET and WMO are working jointly on the formalization of collaboration through Memorandum of Understanding. This agreement can include recognition of EANET as DCPC within WIS.

Comment [OT3]: This was a proposal from David Thomas. EANET still has not signed MoU with WMO as it requires several formal steps

BADC (British Atmospheric Data Centre) archives ground-based, airborne in-situ, remote sensed data of atmospheric chemistry, meteorology and earth observations as well as derived products mostly collected by UK institutions. The 20-yr long archive contains both primary and secondary data. Data providers are atmospheric/earth observation researchers/academics from within and outside the UK, as well as UK Met office and EUMETSAT. Users are predominantly UK academics (about 65%). Use more than one data format and data management plan is agreed upon with data provider. Data sharing policy is open access for a minimum of 2 years, some with mandatory registration and some without.

The Global Precipitation Climatology Centre (GPCC) is a WMO network data centre tasked with the quantitative assessment of global precipitation and the investigation of the global water cycle. GPCC holds a database of primary QC'd monthly and daily precipitation data from 100,000 stations worldwide and re-distributes observation-based gridded data analysis products (e.g. drought index). Data users include many international organizations (including programmes within WMO) as well as scientists, schools and the finance sector. NRT data are collected via the WMO Global Telecommunication System (GTS). Non-NRT data are obtained from National Met. & Hydrol. Centres of WMO, historical data collections and international projects. No copyright is claimed on collected data, hence no re-distribution to third parties. Requests are deferred to the original data provider.

ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network) is a network of observing stations, exploratory platforms, instruments calibration centres, and a data centre, offering high quality data for atmospheric gases, clouds, and trace gases.

IAGOS (In-Service Aircraft for a Global Observing System) is a database of primary aircraft-based measurements of a large number of species of reactive gases, greenhouse gases and aerosol chemistry composition from around the globe. Data providers include IAGOS-core and IAGOS-CARIBIC instrument PIs. It collects NRT data (3 day) and final data (2-6 months) based on ISO compliant and private metadata formats. The data sharing policy is open upon request given description of work and user registration for to track use statistics. Discussions are underway for IAGOS to become a GAW contributing network.

The community further raised the following issues related to data management and sharing:

- data related to water availability or carbon cycle have a commercial value (e.g. water can be considered as a commodity), this can be an issue for open data policy;
- user community in some cases prefers that the added value products rather than individual station data are shared (e.g. GlobalView is a good example);
- there is a duplication of data submissions in national and global data centres.

These issues were later reflected in discussions.

3. **Prioritization of requirements for future GAW data management**

The discussion session on the second day of the workshop was open by Jochen Dibbern (Chair of the WMO Open Programme Area Group on Integrated Observing Systems, OPAG-IOS). He summarized the discussions of the first day of the meeting. His recommendations are like follows:

- distributed data centres is a good approach but metadata must be made available centrally (e.g. through GAWSIS);
- data centres/depositories should jointly work on harmonization of data format, output and quality assurance procedures;
- data providers supporting WMO activities are recommended to use WMO infrastructure (WIS) and be linked to it as DCPCs;
- GAWSIS should include all the links to the other archives;
- harmonized data policy should be developed.

The participants agreed that interoperability plays an important role in the data management system. There was also a general acceptance that as GAW is supported by scientific community it should recognize that individual scientists are looking for individual visibility. Sandro Fuzzi mentioned that GAW residence within WMO structure plays sometimes a role of a limiting factor for

the institutions outside of National Met services. NMHSs need some capacity development to improve their understanding of the role of atmospheric composition for many applications relevant to their mandate.

After the short introduction, Martin Shultz moderated a brainstorming/gap analysis session on the future requirements for GAW data management. Points raised by participants are as follows:

Strengths

- GAW data centers are part of a more comprehensive system supported by international organisation.
- Specific user community: scientific community and countries are aware of the system and use it
- GAW data are trusted (security and QA procedures)
- GAW data policy strikes a good balance between open avaiability and interest of data providers
- Long-term perspective and long-term data series, consistency
- GAW PIs understand process and importance of underlying metadata
- Relation between data center and SAGs by topic helps maintain the identity of GAW
- Global participation
- Beginning availability of global products with global coverage
- Distributed architecture
- (opportunity: gowing demand for NRT data)

Weaknesses

- Sometimes data are difficult to collect within time limits
- Tension between ambition and lack of funding
- Poorly federated distributed architecture
- Reluctance of met services to share atmospheric composition data and relate to the scientific community
- Lack of service provision, for example with respect to high impact weather
- Confusion of contributing networks with GAW; unclear relations
- (What means “mesurement of GAW“ or “measurement for GAW“?)
- Not all data are compliant with quality objectives – hard to judge for users
- From an operational perspective it‘s a weakness that GAW relies on researchers with unknown committment
- Sometimes outdated metadata in GAWSIS, not always consistent information
- Changing scope from „background“ to cover all scales
- GAW is not recognized as research infrastructure but as monitoring infrastructure (depends on whom you ask: from within WMO it is seen as research, from the science community it is seen as monitoring, partly because it is hosted by WMO)
- Geographical gaps

Threats

- Lack of understanding of importance of atmospheric composition data in Met Services
- Scale boundaries are crumbling, no longer “affordable“ to focus only on “background“; grey zone of “regionally representative stations“; this also affects boundaries between agencies
- Sustainability of observations (in some areas at least)
- Poor connection to user communities other than scientists; threat for building services (example: use of GAW data in IPCC only indirectly)
- Very poor collaboration with EPAs and other organisations (now more important because of grey zone)
- Communication about GAW must be improved
- Lack of coordination between different measurements; too few supersites
- Data security

- Evolving role of atmospheric composition measurements from space
- No revenue; dependence on project money
- Responsibilites with respect to regulatory monitoring – arising needs for NRT and threat of penalties and liability
- Preserve ownership by PIs when it comes to services

Needs

Within GAW

- Better statistics of data use and user tracking
- Define the role of partners and contributors
- Define the scope of GAW unambiguously
- Re-definition of the stations and station categories
- More automated status updates: active measurements and stations
- Improved interoperability architecture and harmonized standards/formats
- Build up a service strategy, but preserve ownership of data
- More feedback from user communities as to wha type of services that are actually needed
- Provision of NRT data
- Review structure of WDCs and/or SAGs in order to accomodate cross-cutting services (but services will find their data)
- Make sure that uncertainty information is available
- Improve geographical coverage
- Increase synthesis efforts
- Develop an interoperable application that demonstrate GAW
- Backup of WDCs among each other (GISC model)

Globally

- Advocate the data providers rights in world of interoperability
- Define the relation of GAW WDCs in relation to ICSU data centers
- Try to persuade Met Services and EPAs in some countries to better work with researchers in order to fill coverage gaps where measurements exist (positive example: EUMETNET)
- Harmonisation between GAW and other data centers; avoid duplication or at least have clearly defined roles
- Integration of data across data centers in order to build services (e.g. NWP, health, vegetation)
- Self-assessment of data providers (example from CORE-CLIMAX)
- Relation with GCOS, expand/clarify role of GAW as reference network for specific variables

4. Break out group discussions on the GAW data management strategy

On Day 2, participants were asked to split up into three breakout groups to come up with the following:

- A vision for how to manage GAW data, related data and potential service delivery,
- Organizational structure needed to best support GAW data management including a new Terms of Reference of data centres, and
- Review of the ToRs for existing GAW WDCs as well as other data centres that are affiliated with GAW and formulate a strategy on how to engage them.

Two break-out groups came up with a similar vision of GAW data management.

Vision for GAW data management should be base on:

- Bringing together atmospheric composition data/information including near real time data, with a global perspective concerning geographical coverage and multiple parameters,

- Supporting and providing information on changing atmospheric environment
- Developing better and new services,
- Ensuring data citation and preservation

This vision includes data collection and integration, information and services provision, contributors acknowledgement and data preservation.

New data management tools should include the following:

- *Discovery service*: To develop a global metadata catalogue to get a global view of atmospheric composition data, wherever they are located and how to get them.
- *Quality control and assurance and archiving of* GAW data
- *Access and retrieval services*: Near real time and validated data
- *Value-added services*: visualisation, aggregation, subsetting, forecasting and reanalysis
- A One Stop Shop (a global gateway) for atmospheric composition data

The other formulation of vision:

- Atmospheric composition and related physical parameter data assets are effectively processed, of known quality and effectively stored to facilitate easy discovery, access, use, expansion and exchange.
- This is essential to inform the decision making processes at the local, regional and global levels on the effects of atmospheric composition change on climate, air quality, weather, ecosystems, and human health.
- In this context, the role of GAW is to serve as the authoritative information source through the facilitation of international collaboration on the environmental issues related to atmospheric composition change.

Comment [SC4]: Oksana: Does this stand for something in particular?

Comment [jkl5]: I removed the "ATI acronym, as it doesn't add anything but confusion.

Proposed organizational structure of data management:

- Establish a federation of data centers
  - GAW data centers
  - Contributing network data centers
  - Interconnection through metadata exchange with GAWSIS system
  - Better interoperability between data centers
  - Cross-cutting bodies at the SAG level (e.g. ad hoc working groups)
- Define GAW data from contributing data centers
  - Define the role of campaign data
  - Define how to treat the sites that don't meet current GAW criteria
  - Ensure proper reference through comprehensive metadata
- Range of variables
- Notion of global, regional, local should be clarified
- Host and/or produce services
- Provide data to a non GAW service

Proposed revised Terms of Reference for WDCs (to be include in the new GAW Implementation Plan)

- WDCs should work with the SAGs to implement the GAW strategic / implementation plan.
- Work with expert teams and partners to establish harmonized data management guidelines, including standardized data formats to allow for appropriate (seamless) interoperability.
- Check submitted data for necessary format elements and the availability of comprehensive metadata and reject the submission of data that do not meet these formal criteria. [Another working group felt no data should ever be rejected but should be flagged instead by both the data provider (e.g., based on instrument performance, site conditions) and after by WDC (e.g., based on performance in round robin intercomparisons.]
- Perform plausibility and consistency checks on submitted data, flag data quality issues, and provide feedback to the stations (e.g. to the principal operator), when necessary.
- Provide users an easy access to observations and data products of known quality through an appropriate archiving or archive networking mechanism.
- Support the WMO data discovery objectives.
- Support the dissemination of GAW data for applications that require NRT availability.
- Allow for delivery / discovery of external related data and services

Other points related to the role of WDCs:

- Ensure traceability and proper reference to the data providers
- Provide support to services such as modeling efforts and assessments through easy machine to machine data transfer according to WIGOS requirements.
- Provide a repository of GAW data with long term commitment for the benefit of future generations
- QA/QC of data including link to calibration centre
- Check data format and metadata standard
- Provide defined interfaces to the GAW system?
- Provide user interface (portal?)
- Interoperate with other data centres
- Provide better statistics and user tracking
- Corporate design for the WDCs?
- Backup strategy, one WDC backs up the data of another WDC

Key outcomes, issues and conclusions

- Participants agreed on the need for global, high-quality atmospheric composition data coordination
- There is support for GAWSIS as the international metadata gateway/hub for access to atmospheric composition data
- The distribution of data among Met Services and other sources is a current reality
- There is a need for the management of data (other than metadata) whether it exists with a WDC or other data centres
- There is a need to define how other data centres/contributing networks could be included as part of the federated approach (e.g., global data gets submitted to WDCs and regional data to regional databases).
- There is a recognition that future data management system should be built as a **federated system** of the data archiving and service providing centers.

Based on conclusions of the workshop EPAC SSC will develop further the data management strategy in GAW in cooperation with ET-WDC. This will be presented and further discussed at the SSC meeting in spring 2016.

Final meeting agenda

Monday, 10 August 2015

08.30 – 09.00	Registration
09.00 – 09.30	Welcome and logistics, introduction of participants (J. Klausen)
09.30 – 09.45	Objectives of workshop (G. Carmichael)
09.45 – 10.30	Services provided by existing archives in GAW - WOUDC (T. Colavecchia) - WDCGG (H. Koide) - WDCA (M. Fiebig)
10.30 – 11.00	Coffee break - WDCPC (S. Carou for V. Bowersox)
11.00 – 12.00	- WRDC (A. Tsvetkov) - WDC-RSAT (J. Mayer-Arnek) - GAWSIS (and OSCAR) (J. Klausen)
12.00 – 13.30	Lunch break
13.30 – 15.00	Services provided by the other archives/data bases [short presentations by representatives following the template, 10 min] (chair: C. Labuschagne) - WIGOS/WIS (D. Thomas) - US EPA, HTAP (T.Keating) - EMEP (K. Tørseth) - GEO AQ CoP, TOAR data base (M. Schultz) - MPLNet and AERONET (E. Welton) - EARLINET (G. Pappalardo) - AEROCOM (N. Schutgens) - CDIAC (M. Krassovski) - EANET (K. Sato) - BADC (W. Garland)
15.00 – 15.30	Coffee break
15.30 – 16.00	Services provided by the other archives/data bases [continued] - Precipitation Data Center (A. Becker) - ACTRIS (C. Plass-Dülmer) - IAGOS (D. Boulanger)
16.00 – 17.00	Gaps in existing services and collection of requirements (“fish bowl” and group work; moderation: J. Klausen)
17.00 – 17.30	Wrap-up of day 1 and organization of day 2 (J. Klausen)
17.30	Adjourn

Tuesday, 11 August 2015

09.00 – 09.30	Warm-up: what have we learnt so far? (J. Dibbern)
09.30 – 10.30	Prioritizing requirements for future GAW data management (moderation: M. Schultz)
10.30 – 11.00	Coffee break
11.00 – 12.30	Discussions on the GAW Data management strategy (break-out groups) - **WG1** (chair: G. Carmichael, rapporteur: M. dell'Acqua): scope out a vision for how to manage GAW data, related data and potential service delivery - **WG2** (chair: Sandro Fuzzi, rapporteur: C. Labuschagne): review the organizational structure needed to best support GAW data management and (re)define Terms of Reference (ToRs) - **WG3** (chair: Zhang Xiaoye, rapporteur: Frank Dentener): review and update the ToRs for existing GAW WDCs as well as other data centers that are to be affiliated with GAW and formulate a strategy of how to engage them
12.00 – 13.30	Lunch break
13.30 – 15.00	Discussion in the break-out groups (continued) - **WG2**: scope out a vision for how to manage GAW data, related data and potential service delivery - **WG3**: review the organizational structure needed to best support GAW data management and (re)define Terms of Reference (ToRs) - **WG1**: review and update the ToRs for existing GAW WDCs as well as other data centers that are to be affiliated with GAW and formulate a strategy of how to engage them
15.00 – 15.30	Coffee break
15.30 – 17.30	Presentation of working group results, further discussions and follow-up and wrap-up of day 2 (Rapporteurs)
17.30	Close of workshop