



## Assessment Information

[CoreTrustSeal Requirements 2017–2019](#)

Repository:

WDC - Renewable Resources and Environment

Website:

<http://eng.wdc.cn>

Certification Date:

14 February 2019

This repository is owned by:

Institute of Geographic Sciences and Natural Resources Research,  
CAS

**CoreTrustSeal Board**

W [www.coretrustseal.org](http://www.coretrustseal.org)

E [info@coretrustseal.org](mailto:info@coretrustseal.org)



# WDC - Renewable Resources and Environment

## Notes Before Completing the Application

*We have read and understood the notes concerning our application submission.*

True

*Reviewer Entry*

**Reviewer 1**

Comments:

**Reviewer 2**

Comments:

Accept

## CORE TRUSTWORTHY DATA REPOSITORIES REQUIREMENTS

### Background & General Guidance

### Glossary of Terms

## BACKGROUND INFORMATION

### Context

*R0. Please provide context for your repository.*

*Repository Type. Select all relevant types from:*

Domain or subject-based repository

### *Reviewer Entry*

#### **Reviewer 1**

Comments:  
Accept

#### **Reviewer 2**

Comments:  
Accept

## ***Brief Description of Repository***

The WDC-RRE is a repository for scientific data.

The WDC-RRE is affiliated to the Institute of Geographic Sciences and Natural Resources Research (IGSNRR), Chinese Academy of Sciences [1]. The IGSNRR is a multidisciplinary research institute focusing on, among others, physical geography and global change, human geography and regional development, natural resources and the environment, geographical information systems and surface simulation, the terrestrial water cycle and water resources, ecosystem network observation and modelling, and the Chinese agricultural policy. Through research in these domains, the institute aims to solve major natural resource and environmental problems related to the national sustainable development and improve its own innovative capacity simultaneously.

The institute is home to the State Key Laboratory of Resources and Environmental Information Systems, the Chinese Academy of Sciences (CAS) Key Laboratory of Water Cycle and Related Land Surface Processes, the CAS Key Laboratory of Ecosystem Network Observation and Modelling, and the CAS Key Laboratory of Sustainable Regional Development and Modelling. [2].

The institute is focused on the areas of nature resources, environment, and ecology, and is affiliated with two first-class societies: the Geographical Society of China and the China Society of Natural Resources [3, 4].

The subject areas in the WDC-RRE include the branches of geoscience, such as geography, environment, ecology, and natural resources, etc. Among them, natural resources can be divided into water resources, land resources, climate resources, biological resources, energy, tourism resources, etc. The WDC-RRE involves eight special databases, i.e., basic geographic database, natural resources database, population and social economy database, disaster risk reduction database, land use and land cover database, the Loess plateau agriculture and environment database, temperature spatial database, as well as regional and thematic database [5].

[1] [http://english.igsnrr.cas.cn/ic/ios/201804/t20180411\\_191580.html](http://english.igsnrr.cas.cn/ic/ios/201804/t20180411_191580.html).

[2] [http://english.igsnrr.cas.cn/ai/bi/201705/t20170526\\_177535.html](http://english.igsnrr.cas.cn/ai/bi/201705/t20170526_177535.html)

[3] <http://www.gsc.org.cn/>

[4] <http://www.csnr.org/>

[5] [http://eng.wdc.cn/page/database\\_classification](http://eng.wdc.cn/page/database_classification)

### *Reviewer Entry*

#### **Reviewer 1**

Comments:  
Accept

**Reviewer 2**

Comments:  
Accept

***Brief Description of the Repository's Designated Community.***

The service principles of the WDC-RRE are as follows: data, metadata, products, information produced for research, education, and public domain use that will be made available with minimum time delay and free of charge, or for no more than the cost of dissemination, which may be waived for lower-income user communities to support the equal access [1]. The designated community of the WDC-RRE primarily includes fields such as earth system science, natural resources, environmental conservation, ecological system, and sustainable development. The priority target group comprises researchers in basic and applied research and students; among the other users are government policy makers and the public. In recent years, the WDC-RRE has continuously organized scientific data sharing training workshops for developing countries. Examples include the 2015 International Workshop on Northeast Asia–Central Asia Regional Resources and Environment Data Sharing [2] and the 2016 International Training Workshop on Resources and Environment Data Sharing Technology for the Silk Road Economic Belt [3]. These workshops have nurtured large numbers of young data scientists for the international community.

[1] [http://eng.wdc.cn/page/data\\_use](http://eng.wdc.cn/page/data_use)

[2] <http://www.icsu-wds.org/news/news-archive/wds-co-sponsor-data-sharing-workshop>

[3] <http://www.icsu-wds.org/news/news-archive/wds-presents-at-international-data-sharing-workshop>

***Reviewer Entry***

**Reviewer 1**

Comments:  
Accept

**Reviewer 2**

Comments:  
Accept

***Level of Curation Performed. Select all relevant types from:***

C. Enhanced curation – e.g. conversion to new formats; enhancement of documentation

***Reviewer Entry***

**Reviewer 1**

Comments:  
Accept

**Reviewer 2**

Comments:

Accept

## Comments

At the WDC-RRE, once data is submitted it passes through a “pipeline” for processing and enhancement. The specific steps depend on the unique characteristics of each dataset; however, in general, the WDC-RRE data processors usually perform the data curation processes including data selection and evaluation, data ingestion, data deposit, data access, and dissemination. The process handbook can be seen on the website [1].

All these processes can be divided into seven steps as follows, and some of them need more standard or technique specification support.

- 1) Review data for confidentiality issues;
- 2) Review data entities;
- 3) Review the consistency and integrity of metadata and data entities and revise and improve metadata according to metadata standards [2];
- 4) Review the consistency and integrity of data files and data entities and revise and improve data files according to WDC-RRE data documentation [3];
- 5) Generate multiple data formats for dissemination and preservation;
- 6) Assign persistent identifiers [4];
- 7) Generate thumbnails.

[1] [http://eng.wdc.cn/page/data\\_processing](http://eng.wdc.cn/page/data_processing)

[2] [http://eng.wdc.cn/page/metadata\\_standard](http://eng.wdc.cn/page/metadata_standard)

[3] [http://eng.wdc.cn/page/dataset\\_name](http://eng.wdc.cn/page/dataset_name)

[4] [http://eng.wdc.cn/page/data\\_identification](http://eng.wdc.cn/page/data_identification)

### Reviewer Entry

#### Reviewer 1

Comments:

Accept

#### Reviewer 2

Comments:

Accept

## ***Outsource Partners. If applicable, please list them.***

Our IT team and website operations team are associated with the Northeast Institute of Geography and Agroecology (IGA), Chinese Academy of Sciences, which is a comprehensive research and training base in Northeastern China, specializing in geography, agriculture, ecology, environmental sciences, and technology [1]. The Institute of Geographic Sciences and Natural Resources Research (IGSNRR) is responsible for the whole system operation and cyberinfrastructure renewal, and IGA supported the website development. There has been an agreement about WDC-RRE website software copyright registration between IGSNRR and IGA [2].

[1] <http://english.neigae.cas.cn/au/bi/>

[2] Attachment : Cooperative Development Agreement and the English version of the agreement.

*Reviewer Entry*

**Reviewer 1**

Comments:

Accept

**Reviewer 2**

Comments:

Accept

***Other Relevant Information.***

*Reviewer Entry*

**Reviewer 1**

Comments:

**Reviewer 2**

Comments:

## ORGANIZATIONAL INFRASTRUCTURE

### I. Mission/Scope

***R1. The repository has an explicit mission to provide access to and preserve data in its domain.***

***Compliance Level:***

4 – The guideline has been fully implemented in the repository

*Reviewer Entry*

**Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

**Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

The WDC-RRE ensures the long-term stewardship and provision of quality-assessed data and data services to the international science community and other stakeholders. The WDC-RRE strives to become a long-term data archiving and sharing center in the natural resources and environmental fields in China. The WDC-RRE shall enable the universal and equitable access to quality-assured scientific data, data services, as well as products and information. It ensures long-term data stewardship, fosters compliance to agreed-upon data standards and conventions, and provides the mechanisms to facilitate and improve the access to data in the WDC-RRE. [1]

The WDC-RRE has been established in the former ICSU-WDC framework since 1988 and has served as a regular member of WDS since 2011. The WDC-RRE has clearly confirmed its mission in the collaboration agreement signed between its parent unit and ICSU [2,3].

The Institute of Geographic Sciences and Natural Resources Research (IGSNRR) that WDC-RRE relies upon emphasizes and supports the sharing of scientific data and international collaboration. Currently, two WDS regular members [4,5] have been established under the auspices of this agency. To support the WDC-RRE's mission, the IGSNRR has established the Department for Geo-data Science and Sharing. The director of the WDC-RRC, Professor Wang Juanle, is also the deputy director of the Department for Geo-data Science and Sharing [6].

[1] <http://eng.wdc.cn/page/mission>

[2] [http://english.igsnrr.cas.cn/ic/ios/201804/t20180411\\_191580.html](http://english.igsnrr.cas.cn/ic/ios/201804/t20180411_191580.html)

[3] Attachment : Memorandum of Understanding between the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR) and the International Council for Science (ICSU)

[4] [http://www.icsu-wds.org/community/membership/regular-members/@\\_member\\_view?fid=wdc-renewable-resources-and-environment](http://www.icsu-wds.org/community/membership/regular-members/@_member_view?fid=wdc-renewable-resources-and-environment)

[5] [http://www.icsu-wds.org/community/membership/regular-members/@\\_member\\_view?fid=global-change-research-data-publishing-and-repository](http://www.icsu-wds.org/community/membership/regular-members/@_member_view?fid=global-change-research-data-publishing-and-repository)

[6] [http://sourcedb.igsnrr.cas.cn/zw/zjrck/kygg/xxxt/200908/t20090819\\_2421129.html](http://sourcedb.igsnrr.cas.cn/zw/zjrck/kygg/xxxt/200908/t20090819_2421129.html) (Attachment is the English version of the web page)

### ***Reviewer Entry***

#### **Reviewer 1**

Comments:  
Accept

#### **Reviewer 2**

Comments:  
Accept

## **II. Licenses**

## ***R2. The repository maintains all applicable licenses covering data access and use and monitors compliance.***

### ***Compliance Level:***

3 – The repository is in the implementation phase

#### ***Reviewer Entry***

##### **Reviewer 1**

Comments:

3 – The repository is in the implementation phase

##### **Reviewer 2**

Comments:

3 – The repository is in the implementation phase

### ***Response:***

WDC-RRE is committed to providing open access to scientific data. This open access commitment, however, is balanced with our obligations to the original participants in various research studies. Data provided to WDC-RRE has been collected from research participants (depositors of data) following their research related to natural resources and the environment. Data providers retain all intellectual property rights to their data. A depositor must grant distribution rights to WDC-RRE by conforming to data storage specifications of WDC-RRE [1]. The License is attached with information regarding deposits and relevant forms on the WDC-RRE website. Depositors may engage with the WDC-RRE staff with questions related to licensing and access.

The submitter represents and warrants that s/he is an author of the document associated with the submitted content or has been granted authority by the authors to submit and publish content in the Repository. By submitting content to the Repository, the submitter grants WDC-RRE irrevocable permission to make the data package available to the public. Datasets can be viewed and downloaded from the WDC-RRE website by end users. The submitter represents and warrants that the content does not contain any information (i) that identifies or that can be used in conjunction with other publicly available information to personally identify any individual, or (ii) that is false or misleading. Ordinarily, a data package comprises no more than 20 gigabytes of content; however, larger data packages may be accepted. The primary language of the content must be English. WDC-RRE curators cannot effectively review or curate submissions in other languages at this time.

The scientific data sharing services of WDC-RRE conform to the principles of consideration for user requirements, non-discriminatory open sharing, classification services, emphasis on data content services, and protection of the legal rights of data providers. The platform provides users who access data on this platform with registration and login services, including user registration, user login, user management, and other functions. The WDC-RRE platform is open to the public and does not require mandatory registration, but we encourage users to register so they can download all the available data directly.

Users are expected to abide by the Data use statement of WDC-RRE [2] and other related policies where applicable.



However, by using or downloading the data, users should agree to the conditions stated below:

The user cannot make any use of data to identify or otherwise infringe the privacy or confidentiality rights of individuals discovered inadvertently or intentionally in the data. Any activity involving the use of the scientific data sharing services of WDC-RRE must conform to pertinent national laws and regulations and cannot reveal state secrets or threaten national security. In case of non-compliance with the terms and regulations, the user may be excluded from accessing the resources and incur general legal consequences according to applicable national and international laws [3].

The user will give appropriate attribution to the author(s) of the data in any publication that employs resources provided by the WDC-RRE. All users who retrieve data from this platform have a duty to state the unit (or researcher) generating data used, the data provider, and the acquisition channel when publishing related results of papers. Please refer to the data use statement of WDC-RRE regarding data citation methods [2].

If your use for publication requires permission, you must contact the authors directly; administrators of the WDC-RRE cannot respond to requests for permission. In some cases, an author may choose to control access to their work, for up to 2 years, by which end-user access is moderated through the authors' permission (via email).

[1] [http://eng.wdc.cn/page/data\\_storage](http://eng.wdc.cn/page/data_storage)

[2] [http://eng.wdc.cn/page/data\\_use](http://eng.wdc.cn/page/data_use)

[3] [http://eng.wdc.cn/page/rights\\_security](http://eng.wdc.cn/page/rights_security)

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

For the next renewal, it would be good to see the data use statement split up between a "terms of service" agreement and an explicit "license" agreement that lays out what users of the data are or aren't allowed to do with the data and what their obligations are.

### **III. Continuity of access**

***R3. The repository has a continuity plan to ensure ongoing access to and preservation of its holdings.***

#### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

## Reviewer 2

Comments:

4 – The guideline has been fully implemented in the repository

## *Response:*

### 1. Policy guarantees for data management and sharing in national level

The Chinese government has formulated relevant laws and regulations to promote data sharing, such as the Law of the People's Republic of China on the Progress of Science and Technology [1] and State Administrative Measures for Scientific Data Management [2]. This stable policy environment is a guarantee for the public repositories sustainable development in China, including WDC-RRE.

### 2. Institute guarantees for the sustainable development of WDC-RRE

WDC-RRE is one of the core data services provided by IGSNRR, CAS [3]. As a public scientific research institution in China, IGSNRR will be responsible for the sustainable development of the repository.

### 3. Funding guarantees for long-term operation of WDC-RRE

WDC-RRE is a core service provided by the IGSNRR. Operation of the data center is funded by the CAS Informatization Fund and the National Science and Technology Infrastructure Center in the long term. Currently, the collaboration limit for relevant funding support is until 2022. These funding supports will be continually renewed every 5 years according to Chinese funding period policy. This stable funding mechanism has lasted almost 30 years since the establishment of WDC-RRE in 1988.

In the event that the renewal proposals are not successful, custody is fully transferred by contract to the IGSNRR, CAS. The Institute will be responsible for the sustainable development of the repository and will guarantee the accessibility and long-term availability of the data. As a public scientific research institution in China, the Institute is unlikely to cease operation or substantially change its scope or mission.

### 4. Technology guarantees for the long-term data management and services in WDC-RRE

WDC-RRE ensures the long-term stewardship and provision of quality-assessed data and data services for the international science community and other stakeholders. The WDC-RRE management and operating specifications provide management regulations and protection measures for the continuous access to data [4].

(1) Operational management of WDC-RRE: To ensure the continuous operation of the WDC-RRE platform, besides the stable cyberinfrastructure in CAS, the data center has established a corresponding organizational structure and consulting agencies, such as its expert committee and user committee.

(2) Data management of WDC-RRE: Centralized management is carried out for all metadata in this platform. Data management must be carried out according to relevant specifications. Systemic updates and the expansion of secondary data are carried out in the data center every year.

(3) Service management of WDC-RRE: The data center website provides friendly data co-sharing capabilities and ensures that the system will run continuously 24×7. The services provided by the data center to users can be classified into data enquiry, browsing, downloads, and data information and knowledge dissemination services.

[1] [http://www.gov.cn/flfg/2007-12/29/content\\_847331.htm](http://www.gov.cn/flfg/2007-12/29/content_847331.htm) (Attachment is the English version of the beginning )

[2] [http://www.gov.cn/zhengce/content/2018-04/02/content\\_5279272.htm](http://www.gov.cn/zhengce/content/2018-04/02/content_5279272.htm) (Attachment is the English version of the

beginning)

[3] <http://english.igsnrr.cas.cn/sd/>

[4] [http://eng.wdc.cn/page/management\\_operating](http://eng.wdc.cn/page/management_operating)

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

Accept

## **IV. Confidentiality/Ethics**

*R4. The repository ensures, to the extent possible, that data are created, curated, accessed, and used in compliance with disciplinary and ethical norms.*

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

Handling research data responsibly is fundamental for the Repository. When data are submitted to WDC-RRE, the depositor must comply with data storage specification of WDC-RRE [1]. All submitted data are reviewed by the Repository's management staff, who will communicate directly with the depositor to ensure that the copyrights, personal privacy, and legal rights of data are protected.

WDC-RRE respects the privacy of users and submitters and works to protect all personally identifiable information that we collect. Data with disclosure risks will not be published in the Repository.

The scientific data stored by WDC-RRE are mainly related to the natural geography and ecological/environmental fields. The scale of these spatial data is often on the grid scale of 1 km, or less than or equal to a 1:1 million scale. Statistical

data are usually at the county level [2]. Therefore, data that are on a mesoscale do not involve personal information, sensitive geographical coordinates, or other microscale information; rarely do they have a risk of privacy disclosure. Even so, WDC-RRE has a dedicated team for preserving and processing [3] to examine disclosure risks for all data.

[1] [http://eng.wdc.cn/page/data\\_storage](http://eng.wdc.cn/page/data_storage)

[2] <http://eng.wdc.cn>

[3] [http://eng.wdc.cn/page/process\\_data](http://eng.wdc.cn/page/process_data)

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

Accept

## **V. Organizational infrastructure**

*R5. The repository has adequate funding and sufficient numbers of qualified staff managed through a clear system of governance to effectively carry out the mission.*

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

The WDC-RRE is affiliated with the Institute of Geographic Sciences and Natural Resources Research (IGSNRR), which is hosted by the Chinese Academy of Sciences (CAS) [1]. The IGSNRR was established in 1999 through the merger of the former Institute of Geography, founded in 1940, and the former Commission for the Integrated Survey of Natural Resources, founded in 1956. In the past half century, IGSNRR and its predecessors have led the way in geographical

research in China, making significant research contributions in the rational use of natural resources, ecological and environmental protection, comprehensive land consolidation, sustainable regional development, and resource and environmental information systems. At present, IGSNRR is a multidisciplinary research institute focusing on, among other things, physical geography and global change, human geography and regional development, natural resources and the environment, geographical information systems and surface simulation, the terrestrial water cycle and water resources, ecosystem network observation and modeling, and Chinese agricultural policies.

#### 1. Sufficient numbers of qualified staff

The WDC-RRE team is attached to the Department for Geo-data Science and Sharing of the IGSNRR. The team includes 14 full-time staff and nearly 20 other full-time and part-time personnel (including a five-person IT team). WDC-RRE employees have extensive data management experience, with many of them being experts in the field of data management and sharing. The core staff involved in data process and management can be seen on the website [2]. The academic and field experiences of the staff can be viewed through the link by clicking the staff names on the webpage [2]. Among them, the current director of WDC-RRE is also on the editorial boards of the Data Science Journal of CODATA [3], which is affiliated with the sister data organization of WDS in ISC.

WDC-RRE personnel participate in academic exchanges in China and overseas on a regular basis [4, 5]. In recent years, WDC-RRE has also organized training workshops conducted by experts (including the personnel of the center) in the field for international students [6, 7]. A new international training session on data sharing and disaster risk reduction knowledge service was held in October 2018 [8].

#### 2. Adequate funding for the WDC-RRE mission carrying

As mentioned previously, the WDC-RRE is affiliated with the IGSNRR, and funding support for the operation of its data center is jointly provided by the CAS (under its Special Project on Informatization) and the National Science and Technology Infrastructure Center in the long term. At present, funding support has been contractually secured until 2022. These funding supports will be continually renewed every 5 years according to Chinese funding period policy. This stable funding mechanism has lasted almost 30 years, since 1988 when the WDC-RRE was established. This funding is sufficient to guarantee the sustained and continued operation of the repository.

[1] <http://english.igsnrr.cas.cn/>

[2] [http://eng.wdc.cn/page/process\\_data](http://eng.wdc.cn/page/process_data)

[3] <https://datascience.codata.org/about/editorialteam/>

[4] <http://dc2017.csp.escience.cn/dct/page/1>

[5] <https://council.science/events/wds-asia-oceania-conference>

[6] <http://www.icsu-wds.org/news/news-archive/wds-co-sponsor-data-sharing-workshop>

[7] <http://www.icsu-wds.org/news/news-archive/wds-presents-at-international-data-sharing-workshop>

[8] <http://eng.wdc.cn/post/14ab1>

### *Reviewer Entry*

#### **Reviewer 1**

Comments:

Accept

#### **Reviewer 2**

Comments:

## VI. Expert guidance

***R6. The repository adopts mechanism(s) to secure ongoing expert guidance and feedback (either inhouse or external, including scientific guidance, if relevant).***

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### ***Reviewer Entry***

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

The WDC-RRE has cited stipulations regarding the appointment of members to its Expert and User Committees in its management and operating specification [1]. These members are part of the important mechanism that provides expert guidance for the data center.

The WDC-RRE experts committee [2] provides consultation for decision-making, formulates the center's developmental plans, and offers expert opinions. Its main responsibilities include executing top-level planning for the data center's overall development; providing consultancy and suggestions for the establishment of a mechanism for the data center's long-term operation, development, and new technologies that should be adopted for the storage repository; participating in the inspection and assessment of the data center; and supervising its operations. This committee comprises 15 experts from related fields including earth system science, data management, policy making and regulation, information and network technologies, and management science.

The WDC-RRE user committee [3] studies and evaluates the WDC-RRE's data resource requirements and provides feedback on the service quality of the platform's operations. Its main responsibilities include providing suggestions on users' data resource requirements, conducting quality reviews on data and metadata, studying the distribution and preservation of data on resources and environmental science in China and overseas, analyzing and recommending users for major scientific research projects and key units, and providing feedback on the comments and suggestions made by frontline scientists regarding this platform. This committee is made up of 15–20 members who are experts in fields related to earth system science, frontline scientists, and data users. Dynamic adjustments are made depending on the field of

research in which they are engaged.

The WDC-RRE communicates with and obtains feedback from the Expert and User Committees regularly through consultation meetings. Depositors and users can also communicate with the WDC-RRE, raise queries, or provide feedback through the email link on its webpage. WDC-RRE personnel regularly participate in community activities, seminars, and conferences. Examples include the 4th China Conference on Scientific Data [4] and the WDS Asia-Oceania Conference [5], both of which were held in 2017. In addition, the center will be hosting the 2019 WDS Asia–Oceania Conference [6]. These events provide personnel working in the center with opportunities to learn and seek guidance from Chinese and international experts.

[1] [http://eng.wdc.cn/page/management\\_operating](http://eng.wdc.cn/page/management_operating)

[2] [http://eng.wdc.cn/page/experts\\_committee](http://eng.wdc.cn/page/experts_committee)

[3] [http://eng.wdc.cn/page/council\\_user](http://eng.wdc.cn/page/council_user)

[4] <http://dc2017.csp.escience.cn/dct/page/1>

[5] <https://council.science/events/wds-asia-oceania-conference>

[6] <http://www.wds-china.org/meeting201905.html>

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

Accept

## **DIGITAL OBJECT MANAGEMENT**

### **VII. Data integrity and authenticity**

*R7. The repository guarantees the integrity and authenticity of the data.*

#### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

## ***Response:***

Data processing handbook of WDC-RRE [1] describes the ingestion and processing of data and the type of data and metadata files that are created. For each dataset, WDC-RRE processes the Submission Information Package (SIP), turning it into an Archival Information Package (AIP) for long-term preservation. The AIP contains entity data, metadata, data description documents, and thumbnails. The AIP is used to produce a Dissemination Information Package (DIP) that contains entity data.

### **Integrity**

(1) Checksums for the data archived at WDC-RRE are routinely generated and compared to previous values to ensure the integrity of the data (AIPs). If the checksums do not match, files are investigated for errors. If any inconsistencies are found, they are reviewed and fixed. ① In the data transfer phase: Calculate and record the fixity of each file, and communicate with the archivist to verify the information. In addition, virus scanning is performed on a regular basis to ensure normal operation of the system. ② In the data storage phase: The data will be automatically stored and backed up, and the media are automatically monitored for block-level integrity. In addition, the WDC-RRE's storage system automatically records the fixity of each object (data and metadata). If it finds errors, they will be solved manually.

(2) The WDC-RRE Data Processing Manual describes the WDC-RRE workflow in detail and elaborates the steps for employees to handle data storage. In the process of metadata and data document editing, multiple man-machine inspection ensures the integrity of metadata and data files. In addition, any operations on data and metadata are only performed on copies; the original submitted version will always be saved and will not be modified.

All of the above data processing will follow data quality control specification of WDC-RRE [2].

(3) There are two types of changes applicable to the data archive; One is version change, meaning that the data is updated to a new version, while the other refers to the case in which the data itself does not change but the metadata and data files change slightly. All changes to data and metadata are written in a prescribed format and are recorded in the data description document that is saved along with the AIP. ① When data is updated to a new version, the data archive recreates all descriptive and structural metadata and retains the old file and the previous AIP within the preservation system. The new dataset is assigned a new persistent identifier. This way, the existing persistent identifier will continue to refer uniquely to the earlier version of the dataset. The new and the previous dataset are cross-referenced in their respective descriptive metadata. ② Alternatively, when there is a minor change, no new persistent identifier is minted. Permanent identifiers are specified in the specification of WDC-RRE data identification [3].

### **Authenticity**

(1) The WDC-RRE itself does not make any changes to the data. All data version changes are initiated by the depositor. When the data version is changed, the WDC-RRE assigns it a new data identifier, and the data description document for each new version of the data records the changed characteristics. The WDC-RRE manager will slightly modify the metadata and data files according to the WDC-RRE metadata standard (V1.0) [4] and the data documentation [5] while communicating with the depositor.

(2) The depositor provides the available documentation about the creation of the data and how the data can be used. Part of the assessment of the data by the data archive consists of verifying whether the deposited data have not been corrupted, e.g. whether the checksums are correct and whether the files can be opened without errors. It consists



furthermore of verifying whether the deposited data is in preferred formats and authentic and thus represents the complete/correct information collected in the project. After the curation and/or acceptance of the dataset, the dataset will be sent to archival storage, where it will be stored in a redundant manner and monitored for fixity changes. When unintended changes appear, the authentic copy will be determined and retrieved, and the event will be recorded in the data description document. The data description document is stored in the AIP, along with each version of the data, ensuring that the data change information can be checked. The data, metadata, and data description document will be published.

[1] [http://eng.wdc.cn/page/data\\_processing](http://eng.wdc.cn/page/data_processing)

[2] [http://eng.wdc.cn/page/quality\\_control](http://eng.wdc.cn/page/quality_control)

[3] [http://eng.wdc.cn/page/data\\_identification](http://eng.wdc.cn/page/data_identification)

[4] [http://eng.wdc.cn/page/metadata\\_standard](http://eng.wdc.cn/page/metadata_standard)

[5] [http://eng.wdc.cn/page/dataset\\_name](http://eng.wdc.cn/page/dataset_name)

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

Accept

## **VIII. Appraisal**

***R8. The repository accepts data and metadata based on defined criteria to ensure relevance and understandability for data users.***

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

Data evaluation with WDC-RRE includes three parts: inspection evaluation by quality reviewers of the data center, user evaluation, and expert evaluation.

### 1. Data quality review and evaluation

The WDC-RRE data quality control specifications specify data evaluation [1]. Data quality evaluation includes data content evaluation, data quality evaluation, and data applicability evaluation. Data content evaluation refers to having a preliminary understanding of data content based on the data titles, keywords, abstracts, sources, data providers, and other information. In some cases, it is possible to increase the understanding of data content by downloading some sample data. Data quality evaluation primarily refers to reading and evaluating quality elements such as data integrity, consistency, and accuracy. Applicability evaluation means that, according to the evaluation results of data content and data quality in conjunction with the user-specific purpose of the data use, users determine whether the data meets the requirements for use.

In the process of data quality review, WDC-RRE needs to use the following standards: WDC-RRE data processing handbook [2], WDC-RRE metadata standard (V1.0) [3], WDC-RRE data documentation [4], and WDC-RRE data storage specifications [5]. The data evaluation contents specified in the WDC-RRE data processing handbook include data availability, security, privacy and confidentiality considerations, copyright and other legal issues, data quality, and data format.

### 2. User data-quality evaluation

Data quality evaluation by users mainly refers to user feedback on the quality of the information of the dataset in use. User evaluation results can be given online or offline. The online evaluation function can be implemented only after user login. Users can take into consideration the specific status of data quality and use the information evaluation module of the relevant dataset to grade data quality on a scale from 1 to 5, as shown in the interface [6]. The offline mode refers to giving feedback to WDC-RRE via emails; the contact information can be seen on the bottom band of the website homepage [7].

### 3. Expert data-quality evaluation

The user committee [8] is the evaluation feedback agency of WDC-RRE responsible for the requirements investigation of data resources and the evaluation feedback of platform-operation service quality. At the same time, the WDC-RRE expert committee [9] participates in data center inspections and assessments.

WDC-RRE also uses peer review for quality assessment of data papers. For instance, many datasets published by this data center were subject to quality inspection by two China-based data publication journals and were published as data papers [10–13].

[1] [http://eng.wdc.cn/page/quality\\_control](http://eng.wdc.cn/page/quality_control)

[2] [http://eng.wdc.cn/page/data\\_processing](http://eng.wdc.cn/page/data_processing)

[3] [http://eng.wdc.cn/page/metadata\\_standard](http://eng.wdc.cn/page/metadata_standard)

[4] [http://eng.wdc.cn/page/dataset\\_name](http://eng.wdc.cn/page/dataset_name)

[5] [http://eng.wdc.cn/page/data\\_storage](http://eng.wdc.cn/page/data_storage)

[6] <http://eng.wdc.cn/info/9d326>

[7] <http://eng.wdc.cn/>

[8] [http://eng.wdc.cn/page/council\\_user](http://eng.wdc.cn/page/council_user)

[9] [http://eng.wdc.cn/page/experts\\_committee](http://eng.wdc.cn/page/experts_committee)

[10] <http://eng.wdc.cn/info/9427d>

[11] <http://eng.wdc.cn/info/97a96>

[13] <http://eng.wdc.cn/info/9b847>

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

Accept

## **IX. Documented storage procedures**

*R9. The repository applies documented processes and procedures in managing archival storage of the data.*

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

This section briefly introduces the data storage process, data update description, and data security strategies for this process in WDC-RRE.

#### **1. Data storage process**

The storage workflow is stipulated in the data storage specification of WDC-RRE [1]. 1) The data provider organizes data according to requirements and prepares to upload data entities and documents after standardization; 2) WDC-RRE carries out quality review on the data submitted by the user[2]. Data integrity and compliance are reviewed when data is accepted for storage and the data storage level is confirmed; 3) Data that has passed the review is stored. WDC-RRE will remind the uploader to submit the final data package before data is released and will backup data at the same time; 4)

The manager reviews the data and document, and data undergoes long-term storage.

## 2. Description of data updating

The WDC-RRE data management and operating specifications [3] specify the data updating and storage protocol. Sharing data can be classified into weekly updates, monthly updates, quarterly updates, biannual updates, annual updates, and multi-annual updates. Systemic updates and expansion of secondary data are carried out in the data center every year. The updated and expanded data should not be less than 10% of the total shared data in the previous year.

## 3. Data storage security regulation

The data storage system is deployed in the Institute of Geographic Sciences and Natural Resources Research, CAS, in Beijing. The data backup system is deployed in the Northeast Institute of Geography and Agroecology, CAS, in Changchun, Jilin Province. The backup data is only used as a backup and cannot be used for other purposes. When a new dataset is being released in WDC-RRE, the dataset is backed up at the same time. The system security document of WDC-RRE network [4] specifies the physical security precautions for data storage.

[1] [http://eng.wdc.cn/page/data\\_storage](http://eng.wdc.cn/page/data_storage)

[2] [http://eng.wdc.cn/page/data\\_processing](http://eng.wdc.cn/page/data_processing)

[3] [http://eng.wdc.cn/page/management\\_operating](http://eng.wdc.cn/page/management_operating)

[4] Attachment: system security document of WDC-RRE network

### *Reviewer Entry*

#### **Reviewer 1**

Comments:

Accept

#### **Reviewer 2**

Comments:

Accept

## **X. Preservation plan**

***R10. The repository assumes responsibility for long-term preservation and manages this function in a planned and documented way.***

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

### *Reviewer Entry*

#### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

#### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

## ***Response:***

WDC-RRE has formulated a data processing handbook and data storage specification detailing how to regulate the technical specifications for long-term data preservation. Data rights and security, data operation and management measures, and network system security specify the quality requirements for long-term data preservation. Data identification specification and data use statement regulate the long-term identification and referencing of data.

### 1. Technical regulations for long-term data preservation

The WDC-RRE data processing handbook [1] references the technical model by OAIS and specifies the technical steps for data preservation and storage.

■ At WDC-RRE, once data is submitted in a Submission Information Package (SIP), the data passes through a “pipeline” for processing and enhancement.

■ WDC-RRE will compress the entity data, metadata, data description document, and thumbnails together into an Archival Information Package (AIP) for storage and provide a unique identifier. The data compression is lossless.

■ When the data user satisfies the data usage policy requirements, WDC-RRE will provide a Dissemination Information Package (DIP) for the user to download through the network that mainly includes the entity data, metadata, data description document, and thumbnail.

The data storage specification of WDC-RRE [2] provides a detailed explanation of the data storage format and workflow.

Preferred file formats include:

- Text: plain text (ASCII, UTF-8), Open Office formats (.doc,.docx,.xls,.ppt, etc.)

Comma-separated (or otherwise delimited) values for tabular data

Semi-structured plain text formats for non-tabular data.

- Images: PDF/A, JPEG/JPEG2000, PNG, Esri Grid, Geo TIFF, Irf, Shp, KMZ/KML, DXF/DWG

- Audio: FLAC, AIFF, WAVE

- Video: AVI, M-JPEG2000

- Compressed/archived formats: GZIP/TAR, ZIP, RAR

Data storage should choose a file format that is conducive to data management, storage and sharing, and avoid problems, such as old data being unreadable or data incompatibility due to software and hardware upgrades. The data is thoroughly checked regularly, and the changes in the file format are reviewed. The file formats that are deprecated or not used are converted (migrated) in time. The data format selection follows these principles: 1) Open, non-dedicated format files; 2) Widely used in the existing environment; 3) Using standard character encoding.

### 2. Security regulations for long-term data preservation

Data rights and security of WDC-RRE [3] provide a detailed statement on data storage: WDC-RRE is contractually entitled to reproduce, process, store, and migrate or decompile the data and to make them available in other databases as part of national or international collective orders for online provision and archiving. Actions relevant for preservation, including the unlikely event of custody transfer, are part of the contract between the data supplier and the WDC-RRE. The database is managed by dedicated professionals who carry out real-time tracking of access status. The data center retains service records of scientific data-sharing that are provided by non-network-based download methods and combines them with the actual situation in order to adopt corresponding counter-measures.

The WDC-RRE management and operating specification [4] and system security document of network [5] state the security problems of long-term data storage. The operation and security safeguards for the data center are managed by the network management staff of the center. The network management staff periodically examines the hardware and software systems of the network, identifies malfunctions and potential risks in a timely manner for management, and completes the website operation log file.

The data backup system is deployed in the Northeast Institute of Geography and Agroecology, CAS, in Changchun, Jilin Province of China, which is separate from the location of the main operational system of WDC-RRE in Beijing. The backup data is only used as a backup and cannot be used for other purposes. When a new dataset is being released in WDC-RRE, the dataset is backed up at the same time.

### 3. Identification and reference for long-term data storage

The specification of WDC-RRE data identification [6] stipulates that a unique identifier be assigned to every dataset that is reviewed and approved. Organizations and individuals can reproduce the data identifier that was assigned by WDC-RRE when citing WDC-RRE data.

The data use statement of WDC-RRE [7] regulates the standardized citation format for data. Organizations and individuals that use WDC-RRE data must provide standardized citation of preserved data.

WDC-RRE has set up a data preserving and processing team [8] responsible for data compilation, management, processing, storage, etc.

[1] [http://eng.wdc.cn/page/data\\_processing](http://eng.wdc.cn/page/data_processing)

[2] [http://eng.wdc.cn/page/data\\_storage](http://eng.wdc.cn/page/data_storage)

[3] [http://eng.wdc.cn/page/rights\\_security](http://eng.wdc.cn/page/rights_security)

[4] [http://eng.wdc.cn/page/management\\_operating](http://eng.wdc.cn/page/management_operating)

[5] Attachment: system security document of WDC-RRE network

[6] [http://eng.wdc.cn/page/data\\_identification](http://eng.wdc.cn/page/data_identification)

[7] [http://eng.wdc.cn/page/data\\_use](http://eng.wdc.cn/page/data_use)

[8] [http://eng.wdc.cn/page/process\\_data](http://eng.wdc.cn/page/process_data)

### *Reviewer Entry*

#### **Reviewer 1**

Comments:

Accept

#### **Reviewer 2**

Comments:

For the next renewal, it would be good to see a bit more detail about how the repository informs itself about potential format obsolescence.

## **XI. Data quality**

***R11. The repository has appropriate expertise to address technical data and metadata quality and ensures that sufficient information is available for end users to make quality-related evaluations.***

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### ***Reviewer Entry***

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

Data quality control specification of WDC-RRE [1] stipulate the quality control specifications for data organization, metadata compilation, data release, data sharing, and application. The following sections elaborate on some technical key points for data quality control.

#### **1. Data quality assessment methods**

Quality assessment at the data review stage emphasizes data authenticity and integrity. The data provider is responsible for the quality of the data entity. However, professional inspection of data format and content will be carried out during the data review process. To this end, the data center will assign the data quality assessment according to the scientific data domain so that staff with a specific scientific background can examine the scientific data in similar field [2]. Aside from data entities, all data resources must provide metadata and data files.

Metadata must conform to WDC-RRE metadata standard (V1.0) [3]. When metadata are not sufficient, informed consent declarations or codebooks are missing, or data are incomplete or do not match the description, the data archivist will request that the data producer fix the issues and redeposit, or the data archivist will resolve the issues.

WDC-RRE strongly prefers data collections that have comprehensive data description documents providing ample information on dataset content features, data sources, and methods of data acquisition and processing to allow users to assess the quality and analytical reliability of the data. The content of the WDC-RRE data documentation [4] includes a data description (number of recorded datasets, amount of data ), database description (type and scope of data, database structure, data directory, data quality description, data protection limit, scientific value, and applications of data, etc.), data usage specifications (data format, enquiry method, etc.), relevant software (enquiry, updating, downloading, etc.), and application scope.

The team for preserving and processing of WDC-RRE data [2] is responsible for WDC-RRE's data compilation, handling, processing, and storage. Since WDC-RRE's designated community is multidisciplinary, it is necessary to work in close cooperation with the depositors. A data curator inspects the provided metadata to verify the consistency,

understandability, and completeness of the data. If any issues arise, the data curator contacts the depositor for further actions. As far as possible, WDC-RRE will assign the curation of the deposited data to staff with a matching disciplinary background.

## 2. Online quality inspection of data

We plan to improve this process by creating a user-friendly web interface that will help depositors to deliver data in standard formats and to provide the required metadata. The metadata schema for WDC-RRE takes into account international standards like the Dublin Core Metadata standard.

## 3. Domain user data quality inspection and feedback

Data quality assessment of domain users is mainly targeted at feedback on the quality information of the dataset itself during the usage status. User evaluation can be completed using online and offline methods. Online assessment requires logging in, and the user can combine specific data quality status to grade data quality on a scale of 1–5 in the information evaluation module of the relevant dataset, as shown in the interface [5] (The scoring system is in the upper right corner of the interface). Offline feedback is carried out using emails to feedback to WDC-RRE. As described in Section VIII.

## 4. Expert quality review

WDC-RRE's expert committee and user committee will also participate in inspection and evaluation of the data center. WDC-RRE also adopts assessment methods similar to those of data papers for quality assessment, and some datasets are evaluated by relevant data journals. As described in Section VIII.

## 5. Identification and reference for data

WDC-RRE data documentation [4] provided by WDC-RRE contains citation specifications to guarantee the long-term tracing of data quality.

Dataset/atlas usage statement and citation: (■) the usage statement serves to identify the dataset/atlas used in the user's research results text, while (■) the citation serves to identify the dataset/atlas used in the references of the research results, or a list that must include referenced published papers or monographs closely related to the dataset/atlas. It can be in either Chinese or English form.

The usage statement can follow the following schema: Author. Dataset/atlas name (Version). Establishment organization [Establishment organization], Establishment time. Communication agency [Communication agency], Communication time. Unique identifier. The resolved addresses.

[1] [http://eng.wdc.cn/page/quality\\_control](http://eng.wdc.cn/page/quality_control)

[2] [http://eng.wdc.cn/page/process\\_data](http://eng.wdc.cn/page/process_data)

[3] [http://eng.wdc.cn/page/metadata\\_standard](http://eng.wdc.cn/page/metadata_standard)

[4] [http://eng.wdc.cn/page/dataset\\_name](http://eng.wdc.cn/page/dataset_name)

[5] <http://eng.wdc.cn/info/9f1c5>

## *Reviewer Entry*

### **Reviewer 1**

Comments:

Accept

### **Reviewer 2**

Comments:

Accept



## XII. Workflows

*R12. Archiving takes place according to defined workflows from ingest to dissemination.*

### *Compliance Level:*

4 – The guideline has been fully implemented in the repository

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### *Response:*

#### 1. The WDC-RRE data processing workflow

The Data processing handbook of WDC-RRE [1] specifies the overall workflow.

(1) Data selection and appraisal. This section indicates four rules that must be followed in the selection of data, and datasets are accorded a high priority for inclusion in the archive. Details on appraisal criteria regulate the requirements on data availability, security, privacy and confidentiality considerations, copyright and other legal issues, data quality, data format and other related issues. The data source section specifies many possible forms of data sources.

(2) Ingest and deposit. The first step is that the data submitter organizes the data according to the requirements and prepares to upload the normalized data entities and files. The second step is that the WDC-RRE performs quality review on the data submitted by the users. While accepting data to be stored, it is necessary to review the integrity and normativity of the data and determine the data storage level. The WDC-RRE offers correction advice for unqualified data and requests users to correct and resubmit the data by the deadline. The third step is to store the data that has passed the review stage. Before the data is published, the WDC-RRE prompts the uploaders to submit the final data package and backs up the data in the meantime. The fourth step is that after the data that is collected is deposited at the WDC-RRE, a data archivist reviews the data and documentation, builds a study description, enhances the documentation, approves the data collection for distribution on the WDC-RRE website, and then archives the data for long-term preservation.

The quality review in data processing comprises three steps. The first step of quality review is the metadata review phase consisting of data review and online publication. Metadata quality review involves two parts namely, checking the integrity of metadata, that is all required items must be recorded; and checking the accuracy of metadata, which requires quality review of all quantitative and non-quantitative metadata information. The second step of quality review is the data review phase. In this phase, in addition to checking the quality of metadata, it is more important to check the quality of dataset

entities that are bound to the metadata. Quality review of the data published online includes checking data integrity and consistency. For some partial data sets that are difficult to judge, the overall technology group and data expert group will be invited to provide guidance. The data that passes the review will be released. Meantime, in the data release process, users are provided with corresponding data files and metadata to participate in data quality assessment.

(3) Access and dissemination. The WDC-RRE disseminates data to researchers, students, policymakers, and the public around the world, based on its Data use statement [2]. Users may download all data directly from the WDC-RRE. Users are expected to adhere to norms for responsible use of the data.

The WDC-RRE still adopts an update mechanism for post-release data [3]. The update of shared data can be divided into various update period, including weekly, monthly, quarterly, semi-annual, annual, and multi-year. The data center systematically update and expand secondary data every year, and the updated and expanded data coverage is not less than 10% of all the data shared in the previous year.

## 2. Staffing in the workflow

The data disposal process is accompanied by a data curator who is in direct communication with the depositor throughout. In addition, the comprehensive data disposal workflow is clearly documented on the WDC-RRE website.

(1) The team for preserving and processing [4]. Process and management of data personnel accounts for 5 percent, data management and service personnel accounts for 11 percent, network operation and maintenance and data backup personnel accounts for 5 percent, data storage management and preservation personnel accounts for 11 percent, data processing and website interface prettifying personnel accounts for 5 percent, data reviewing and processing personnel accounts for 26 percent, data processing personnel accounts for 11 percent, international data receiving and releasing personnel accounts for 5 percent, data quality control personnel accounts for 11 percent, development of data processing tools personnel accounts for 5 percent, work organizing and team management personal accounts for 5 percent.

For some datasets that are difficult to judge, expert committees and user committees will be invited to provide guidance.

(2) Personnel intervention during data services. The data center ensure that the system is powered 24 hours a day, 7 days a week. The duration of any interruption of operations, no matter for what reason, must not exceed 10 days per year. The database is managed by specially assigned personnel, who are supposed to track data access in real time, promptly detect illegitimate intrusions and data theft, and take appropriate measures to rectify it. The network administrator must check the network hardware and software systems on a regular basis, find faults and hidden troubles as well as solve them in a timely manner, and fill in website operation log files [3].

## 3. Timely adjustment of workflow

Workflows are constantly monitored by the management, and improvement of the data archives takes place regularly. As detailed above, all workflows, processes and procedures are detailed in the WDC-RRE, which is a dynamic document, allowing for adaptation and change, wherever necessary. The WDC-RRE stays abreast of developing technologies, and constantly thinks of future options for its growth. All current systems and procedures are maintained until such time as full testing of a new system is implemented. Changes in workflows are drafted and circulated for discussion among the WDC-RRE team, and implemented after the final approval from the WDC-RRE Director is received.

[1] [http://eng.wdc.cn/page/data\\_processing](http://eng.wdc.cn/page/data_processing)

[2] [http://eng.wdc.cn/page/data\\_use](http://eng.wdc.cn/page/data_use)

[3] [http://eng.wdc.cn/page/management\\_operating](http://eng.wdc.cn/page/management_operating)

[4] [http://eng.wdc.cn/page/process\\_data](http://eng.wdc.cn/page/process_data)

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

Accept

## **XIII. Data discovery and identification**

*R13. The repository enables users to discover the data and refer to them in a persistent way through proper citation.*

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

WDC-RRE provides two types of online metadata search and inquiry services [1]. One uses the data classification system on the portal homepage to search for data, while the other uses the one-stop search function on the data portal homepage to search for data.

At WDC-RRE, all data is deposited via an electronic Deposit Form. Files uploaded via this secure system are given unique deposit IDs and moved to the appropriate area for further processing. Physical submissions that arrive at WDC-RRE via removable media like CD-ROMs or DVDs are immediately copied to a secure location, and the copy process is verified to ensure that all files transfer properly.

To promote the open acquisition of WDC-RRE, WDC-RRE has been registered on the multidisciplinary research data and knowledge repository, re3data.org, and the World Data System (WDS).

■ Link to re3data.org: <https://www.re3data.org/repository/r3d100010588>[2]

■ Link to WDS: [http://www.icsu-wds.org/community/membership/regular-members/@\\_@member\\_view?fid=wdc-renewable-resources-and-environment](http://www.icsu-wds.org/community/membership/regular-members/@_@member_view?fid=wdc-renewable-resources-and-environment)[3]

WDC-RRE provides data identification and registration for all datasets through two optional methods. One is the

self-defined scientific data identification specification of WDC-RRE [4]. Once the data identifier of WDC-RRE is assigned to a dataset, it will not change with changes in ownership and management rights. Organizations and individuals should reproduce the data identifier that was assigned by WDC-RRE when reproducing WDC-RRE data. Organizations and individuals that process WDC-RRE data into new data resources should indicate the identifier of the raw data. The second mechanism is to encourage users to adopt the digital object unique identifier (DOI) format for identification. The DOI is a set of mechanisms for identification of digital resources and includes videos, reports, books, etc. Currently, the WDC-RRE has also applied for DOI domains. Examples of some WDC-RRE datasets that have obtained DOI identifiers: 1949–2013 Spatial distribution data for the Dongting Lake dikes (DOI:10.3974/geodb.2014.02.07.V1) [5] and Chlorophyll, a concentration dataset of Chlorophyll for Poyang Lake (2009–2012) (DOI:10.3974/geodb.2014.02.08.V1) [6]. WDC-RRE has its PID policy for versioned data. Data processors update the data set periodically and record the time stamp of data modification. These timestamps will be kept in the PID indicating the information change of the dataset. Accurate citation of data promotes more and better science research, and we believe all data stakeholders can do more to improve data citation. The citation format for scientific data in WDC-RRE is as follows: Author, Name (Version), Created by (Creating institution), Date of creation, Disseminated by (Disseminating institution), Dissemination time, Unique identifier, and Resolved address [7].

[1] <http://eng.wdc.cn>

[2] <https://www.re3data.org/repository/r3d100010588>

[3] [http://www.icsu-wds.org/community/membership/regular-members/@\\_member\\_view?fid=wdc-renewable-resources-and-environment](http://www.icsu-wds.org/community/membership/regular-members/@_member_view?fid=wdc-renewable-resources-and-environment)

[4] [http://eng.wdc.cn/page/data\\_identification](http://eng.wdc.cn/page/data_identification)

[5] <http://eng.wdc.cn/info/9427d>

[6] <http://eng.wdc.cn/info/97a96>

[7] [http://eng.wdc.cn/page/data\\_use](http://eng.wdc.cn/page/data_use)

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

For the next renewal, it would be good to see that the repository takes responsibility for issuing Persistent Identifiers for all data using a widely used PID system such as DOIs.

## **XIV. Data reuse**

***R14. The repository enables reuse of the data over time, ensuring that appropriate metadata are available to support the understanding and use of the data.***

## ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

### ***Reviewer Entry***

#### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

#### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

## ***Response:***

The WDC-RRE aims to maintain the integrity, availability and reusability of its content in the long term. Note that it remains the responsibility of submitters to provide sufficient metadata and additional data description documentation.

■ Establishment of metadata standards for the WDC-RRE [1]. The standards are established by referencing the relevant metadata national standards and industry standards of China and other countries, integrated with the characteristics of the production, storage and service of renewable resource datasets. All datasets must provide corresponding metadata description information, and the metadata must comply with the WDC-RRE metadata standards to ensure authenticity and integrity. The contents of metadata standard are information on mandatory and recommended metadata for the benefit of the users. Mandatory metadata is required to ensure the inner workings of the repository system, while recommended metadata was selected to increase the understandability of data.

■ Establishment of data document templates for the WDC-RRE [2]. The contents of the data files include data description (number of records, data volume), database description (type and scope of data, database structure, data dictionary, quality description of data, data protection period, scientific value and application fields of data, and others), data usage instructions (data format, query methods, and others), related software (inquiry, update, download, and others), and the scope of its application.

To ensure data accessibility, the WDC-RRE data processing handbook [3] constrains the reusability of data and mentions four specific rules in the data selection and inclusion criteria:

1. The WDC-RRE prefers data in a readily usable format, accessible to people across a variety of computing and technological settings.
2. The WDC-RRE prefers data formats that promote easy access and use, without compromising on research value.
3. The WDC-RRE requires that data files deposited in a raw format be transformable or convertible into formats that are usable by various kinds of software.
4. The WDC-RRE prefers data files that are unaccompanied by value-added software. We also provide support in converting the data, if necessary and feasible.

[1] [http://eng.wdc.cn/page/metadata\\_standard](http://eng.wdc.cn/page/metadata_standard)

[2] [http://eng.wdc.cn/page/dataset\\_name](http://eng.wdc.cn/page/dataset_name)

[3] [http://eng.wdc.cn/page/data\\_processing](http://eng.wdc.cn/page/data_processing)

*Reviewer Entry*

**Reviewer 1**

Comments:  
Accept

**Reviewer 2**

Comments:  
Accept

## TECHNOLOGY

### XV. Technical infrastructure

*R15. The repository functions on well-supported operating systems and other core infrastructural software and is using hardware and software technologies appropriate to the services it provides to its Designated Community.*

***Compliance Level:***

4 – The guideline has been fully implemented in the repository

*Reviewer Entry*

**Reviewer 1**

Comments:  
4 – The guideline has been fully implemented in the repository

**Reviewer 2**

Comments:  
4 – The guideline has been fully implemented in the repository

***Response:***

WDC-RRE adopted appropriated hardware and software technologies to well support the repository functions. They are introduced following the sequence of infrastructure and hardware to software and standards. In the future, we can organize them following the OAIS model, which is organized according to the data process pipeline, including data selection, ingestion, storage, preservation, access, and dissemination.

1. Cyberinfrastructure

To ensure continuous operation of the platform, the WDC-RRE management and operating specification [1] specifies the following basic setup requirements: (a) an independent workplace and equipment, including necessary network-related

equipment, such as database servers, WEB servers, big data storage equipment, and any other equipment necessary for setup. Backup mechanism is deployed in a different geographic location; (b) an Internet bandwidth export of at least 10 M/bps to the public information network and provision of necessary network security measures; (c) a big data management system; (d) sufficient server and network capabilities to handle 100 concurrent users in query, browsing, and downloading; and, (e) necessary setup for fireproofing and waterproofing in the workplace. All conditions should comply with class A equipment standards, as specified in the GB50174-93 national standard.

## 2. Technical architecture

Based on the principle of openness and freedom, open-source software systems and applications were adopted in the operating system and data storage. In data management, related technical specifications formulated by international and local centers were followed. Currently, the website is hosted on the Ali cloud platform in China, with the Debian server as the operating system and PostgreSQL as the open-source database storage. The metadata management system was built according to the technical framework in pycsw to ensure compliance with other international and domestic standards. In addition, WDC-RRE is also a technical support unit of the WDS data exchange center in China and backs the establishment of the WDS data portal in the country [2].

## 3. Software support

Many community software systems were adopted in the applications of WDC-RRE, including the Debian Linux operating system, PostgreSQL database, NGINX server, service application development and Python programming language, and the pycsw metadata tool.

## 4. Reference standards

The spatial data operations in WDC-RRE comply with the OGC CSW international standards (currently supporting version 3.0.0) [3], while all data also complies with the WDC-RRE metadata standards, which are compatible with the standards specified in Dublin Core Metadata and ISO19115.

## 5. Platform design and technical documentation

Open-source software was primarily adopted to store and publish metadata and data entity information. To ensure that the information is public and to facilitate user processing, a list of software that is currently adopted, as well as related documentation and user manuals, is provided [4]. Documentation will be updated after each software re-deployment.

[1] [http://eng.wdc.cn/page/management\\_operating](http://eng.wdc.cn/page/management_operating)

[2] <http://www.wds-china.org/>

[3] <http://www.opengeospatial.org/standards/cat>

[4] [http://eng.wdc.cn/page/user\\_manual](http://eng.wdc.cn/page/user_manual)

## Reviewer Entry

### Reviewer 1

Comments:  
Accept

### Reviewer 2

Comments:  
For the next renewal, it would be good to see how the repository's technical infrastructure maps to the OAIS model.

# XVI. Security

***R16. The technical infrastructure of the repository provides for protection of the facility and its data, products, services, and users.***

### ***Compliance Level:***

4 – The guideline has been fully implemented in the repository

#### ***Reviewer Entry***

##### **Reviewer 1**

Comments:

4 – The guideline has been fully implemented in the repository

##### **Reviewer 2**

Comments:

4 – The guideline has been fully implemented in the repository

### ***Response:***

The security policy at WDC-RRE is in place to ensure that valuable digital data remains available (availability), does not become corrupted (integrity), and maintains confidentiality.

Security is assured on different levels:

#### **1. System security**

WDC-RRE has developed a system security document of WDC-RRE network [1]. There are prevention measures used to ensure network security and physical security. In-depth analysis from layer 2 to layer 7 is performed on the network data flow that flows through this critical path. The firewall system uses application-state detection technology of ASPF (Application Specific Packet Filter) to give a real-time detection of the connection status of the application layer and provides functions, such as email alerts, attack logs, flow logs, and network management monitoring to assist users with network management. WDC-RRE adopts a wide variety of measures to ensure physical security, including independent computer room security management, effective solutions to natural and man-made disasters, and stable physical environment protection for normal equipment operation.

#### **2. Network activity monitoring**

The network administrator must check the network hardware and software systems on a regular basis to ensure a timely detection of and solution for faults and hidden problems, and is required to fill in website operation log files. The database is managed by specially-assigned personnel who track data access, detect illegal intrusions and data theft in a timely manner, and take corresponding measures. For scientific data-sharing services not provided through web-based downloads, the data center keeps the service records as evidence to use when necessary to protect the rights and interests.

#### **3. Data storage security**

WDC-RRE has established data security regulations [2]. The data center opens all shareable data to the public.

Confidential data and non-public data should be shared with relevant, qualified departments and units in accordance with



relevant regulations. The confirmation of confidential and non-public data must be based on explicit national or departmental regulations. The data and information should not contain any content prohibited by relevant laws and regulations in China, and WDC-RRE is not allowed to disclose national confidential information and other non-public information to non-authorized personnel in the name of the WDC-RRE data center.

#### 4. Data backup

A strategy for multiple copies/backups, recovery plans, and a description of the risks and actions taken to reduce risk and overcome problems, are included in the Archives Formation Plan. Before data publishing, WDC-RRE prompts the uploaders to submit the final data package and backs up the data in the meantime [3]. Data is stored on the server of WDC-RRE, in IGSNRR, CAS, in Beijing. At the same time, an offsite backup system is deployed at the Northeast Institute of Geography and Agroecology, CAS, in Changchun, Jilin province, China. The backup data is only used as a backup and cannot be used for other purposes. When a new dataset is being released in WDC-RRE, the dataset is backed up at the same time.

[1] Attachment: system security document of WDC-RRE network

[2] [http://eng.wdc.cn/page/rights\\_security](http://eng.wdc.cn/page/rights_security)

[3] [http://eng.wdc.cn/page/data\\_processing](http://eng.wdc.cn/page/data_processing)

#### *Reviewer Entry*

##### **Reviewer 1**

Comments:

Accept

##### **Reviewer 2**

Comments:

Accept

## **APPLICANT FEEDBACK**

### **Comments/feedback**

*These requirements are not seen as final, and we value your input to improve the core certification procedure. To this end, please leave any comments you wish to make on both the quality of the Catalogue and its relevance to your organization, as well as any other related thoughts.*

#### ***Response:***

#### *Reviewer Entry*

**Reviewer 1**

Comments:

**Reviewer 2**

Comments:

## 合作开发协议书

甲方：中国科学院地理科学与资源研究所

乙方：中国科学院东北地理与农业生态研究所

鉴于，协议各方均为计算机软件专业开发人员，能够进行创造性的软件开发活动。并且，协议各方有意愿共同从事 可再生资源与环境世界数据中心平台系统 版本号：V1.0 软件的开发工作。为了规范各方的权利义务，在《中华人民共和国合同法》及其他相关法规政策的原则指导下，订立本协议书，各方共同遵守：

### 第一条、合作宗旨

为完成可再生资源与环境世界数据中心平台系统 版本号：V1.0 软件的开发工作，并共同享有开发成果而合作。

### 第二条 合作项目和范围

协议各方共同开发可再生资源与环境世界数据中心平台系统 版本号：V1.0 软件，合作范围包括软件的代码编写、调试、测试等开发工作。

### 第三条 合作期限

双方从 2016 年 10 月 12 日开始合作开发此软件，期限为 1 年。

### 第四条 合作方式

1. 协议各方按照软件编程工作的正常分工进行编写，任何一方不得随意更改软件的重大功能和事项，以免对其余各方造成履约困难。

2. 合作各方应坚持勤勉努力诚实信用的原则，进行各方分别负责的软件的编程工作，并考虑到各方软件的兼容和接合。如部分合作人发生特殊技术困难，其余合作方有义务为其提供合理适当的技术帮助。

### 第五条 知识产权

1. 各方编写的软件源代码、技术文档及汇编而成的程序本身，其著作权均由合作方共同享有。

2. 各作各方在编写软件的过程中，不得有侵犯他人知识产权的行为，否则，应对外承担全部侵权责任。

### 第六条 协议变更

1. 经合作各方协商同意，本协议可以作相应变更；

2. 任何合作方未经与其他各方协商,擅自变更本协议条款或者将本协议权利义务转让他人,均为无效。

#### 第七条 禁止行为

1. 未经全体合作人同意,禁止任何合作人私自以团体名义进行业务活动;如其业务获得利益归合作各方共有,造成损失按实际损失赔偿。

2. 禁止合作人经营与团队相竞争的业务。

3. 禁止合作方泄露本协议所涉及的相关商业秘密。

4. 如合作人违反上述各条,应按实际损失赔偿。

#### 第八条 合作的终止

合作开发活动因以下事由之一得终止:

- ①全体合作人同意终止合作关系;②合作项目因技术原因,根本不能完成;  
③合作项目违反法律被撤销。

#### 第九条 纠纷的解决

合作各方之间如发生纠纷,应共同协商,本着有利于事业发展的原则予以解决。如协商不成,可以诉诸法院。

第十条 本协议如有未尽事宜,应由合作人集体讨论补充或修改。补充和修改的内容与本协议具有同等效力。

甲方:

日期: 2016年10月12日



乙方:

日期: 2016年10月12日



## Cooperative Development Agreement

(translation)

Party A: Institute of Geographic Sciences and Natural Resources, Chinese Academy of Sciences

Party B: Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences

Whereas, the parties to the agreement are professional computer software developers who are able to carry out creative software development activities, and are willing to work together on the upgrade development of the World Data Center for Renewable Resources and Environment website software v1.0, based on the original operational platform. In order to regulate the rights and obligations of both parties, this agreement is made under the guidance of the *Contract Law of the People's Republic of China* and other relevant regulations and policies, and both parties shall abide by it:

### Article 1 Purpose of Cooperation

To complete the upgrade development of the World Data Center for Renewable Resources and Environment website software v1.0, based on the original operational platform.

### Article 2 Cooperation Projects and Scope

The parties hereto jointly develop the World Data Center for Renewable Resources and Environment website software v1.0, and the cooperation scope includes the software code writing, debugging, testing and other development work.

### Article 3 Term of Cooperation

The two parties started to cooperate on the development of this software on October 12<sup>th</sup>, 2016 for a period of one year.

### Article 4 Mode of Cooperation

1. The parties hereto shall compile in accordance with the normal division of software programming work, and neither party shall change the major functions and matters of the software at will, so as not to cause difficulties to the other parties in performing the contract.

2. The parties to the cooperation shall adhere to the principle of diligence and honesty, carry out the programming of the software to which each party is respectively responsible, and take the compatibility and connection of the software of each party into consideration. If some partners have special technical difficulties, the other partners shall be obliged to provide reasonable and appropriate technical assistance.

#### Article 5 Intellectual Property Rights

1. The software source code, technical documents and programs compiled by the parties shall be jointly owned by the partners.

2. In the process of writing software, each party shall not infringe the intellectual property rights of others, otherwise, it shall bear all the liability for infringement.

#### Article 6 Modification of the Agreement

1. This agreement may be modified as agreed by all parties

2. Any partner who changes the terms of this agreement or transfers the rights and obligations to others without consulting with other parties shall be void.

#### Article 7 Prohibited Acts

1. Without the consent of all the partners, any partner is prohibited from conducting business activities in the name of the group; the benefits obtained from its business shall be shared by all parties, and the loss shall be compensated according to the actual loss.

2. Partners are prohibited from running businesses that compete with teams.

3. The partner shall not disclose the relevant trade secrets involved in this agreement.

4. In case of breach of each of the foregoing clauses, the cooperation party shall compensate for the actual loss.

#### Article 8 Termination of Cooperation

The cooperative development activities may be terminated for one of the following reasons:

①All the partners agree to terminate the cooperation; ②Due to technical reasons, the cooperation project cannot be completed; ③The collaborative project broke the law and was canceled.

#### Article 9 Dispute Settlement

In case of any dispute between the parties, the parties shall negotiate together and settle the dispute in accordance with the principle that is conducive to the development. If negotiation fails, the case may be referred to the court.

Article 10 Matters not covered in this agreement shall be added or modified by the cooperative partner through collective discussion. The supplementary and modified contents shall be equally authentic with this agreement.

**Party A:**

Date: October 12th, 2016

**Party B:**

Date: October 12th, 2016



Dr WANG Juanle  
Institute of Geographic Sciences and Natural Resources Research  
Chinese Academy of Sciences  
A11, Datun Road  
Chaoyang District  
100101 Beijing  
China

18 March 2012

Dear Dr Wang,

I am pleased to be able to send you herewith the signed copy of the Memorandum of Understanding between the Institute of Geographic Sciences and Natural Resources Research of the Chinese Academy of Sciences (IGSNRR) and the International Council for Science (ICSU) relating to the Institute's contribution to the World Data System (WDS).

We very much look forward to working with you and your colleagues for the future success of the WDS.

Yours sincerely,



Dr Howard Moore  
Senior Advisor

Enclosure

c.c.: Dr Mustapha Mokrane, Executive Director WDS



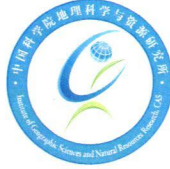


## Memorandum of Understanding between the Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR) and the International Council for Science (ICSU)

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The purpose of this Memorandum of Understanding is to define the conditions under which the IGSNRR will contribute to the ICSU World Data System (hereafter ICSU WDS). This document is not legally binding.

1. IGSNRR was established in 1999 through a merger of two former Chinese Academy of Sciences (CAS) institutes: The Institute of Geography (IOG) and The Commission for Integrated Survey of Natural Resources (CISNAR). The former was established in 1940 and the latter in 1956. Both institutes had a long history of distinguished engagement in and contribution to the development of geography and natural resources inventory and research. IGSNRR currently gives high priority to research focused on physical geography and global change, human geography and regional development, natural resources and environmental security, geo-information mechanism and system simulation, water cycle and related land surface processes, ecosystem network observation and modelling, and agricultural policies. IGSNRR is the host agency of World Data Center for Renewable Resources and Environment (hereafter WDC-RRE), Beijing, China.
2. It is the intention of the WDC-RRE at IGSNRR to contribute to the ICSU World Data System (WDS), and to collaborate with its governing body, the ICSU WDS Scientific Committee, in order to ensure the long-term stewardship and provision of quality-assessed data and/or data services to the international science community and other stakeholders.
3. By joining the ICSU WDS as a member, the WDC-RRE at IGSNRR will work towards achieving the common goals and objectives of the ICSU WDS as stated in the constitution. These are to:
  - a. Enable universal and equitable access to quality assured scientific data, data services, products and information
  - b. Ensure long term data stewardship
  - c. Foster compliance to agreed-upon data standards and conventions
  - d. Provide mechanisms to facilitate and improve access to data
4. The WDC-RRE at IGSNRR commits to fulfil the ICSU WDS criteria for membership, including:
  - a. Accepting the ICSU WDS Constitution 2011 (Annex A).



- b. Complying with the ICSU WDS Data Policy (Annex B) which includes a commitment to full and open exchange of data, metadata and products deposited within the ICSU WDS.
5. No data activities of WDC-RRE at IGSNRR are outside the scope of the WDS.
6. If the WDC-RRE at IGSNRR, for any reason is unable to continue its long-term commitment, then it should endeavour to find a mechanism to secure its data activities in WDC-RRE by transferring them to another ICSU WDS facility or other suitable host organisation.
7. The resources required for the data activities of the WDC-RRE are the responsibility of the IGSNRR. In order to provide continuity, the IGSNRR is expected to provide these resources on a long-term basis.
8. This memorandum of understanding will enter into force upon signature by both parties. It is valid for 5 years from the date of signature and can be renewed for a further period.
9. This memorandum of understanding is to be signed between ICSU and the IGSNRR by the respective heads of organizations or their authorised delegates.

SIGNED   
(On behalf of ICSU)

Date: 13/4/2012

Name: STEVEN WILSON

Position: EXECUTIVE DIRECTOR, ICSU

SIGNED   
(On behalf of IGSNRR)

Date: 2012/03/15

Name: Liu Yi

Position: Director

Juanle Wang

**Personal Profile:**

Researcher and PhD supervisor, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences

Juanle Wang obtained his master's degree in Geodesy and Surveying Engineering at the China University of Mining and Technology in 2002. He earned his PhD degree in Cartography and Geographic Information System at the Institute of Geographic Sciences and Natural Resources Research in 2005. He has been working at the institute since he completed his postdoctoral research in 2007. He was promoted to a research associate in 2009 and then to a researcher in 2015. He is now the Deputy Director of the Department for Geo-data Science and Sharing, the Director of the Data Center for Renewable Resources and Environment of the ICSU World Data System (ICSU-WDS), and the Deputy Director of the Natural Resources Information System Committee of the China Society of Natural Resources.

**Research Interests:**

Resources and environmental data integration and sharing standards, Environmental remote sensing, and GIS applications

**Academic Achievements:**

Juanle Wang has been the principal investigator for projects funded by programs such as the National Natural Science Foundation of China, the Special Scientific Research Fund of Environmental Protection Public Welfare Profession of China and the Key Program of National Basic Work of Science and Technology. He has been long participating in the construction of the National Science and Technology Infrastructure Center for data sharing. He also established standard reference models for sharing of earth system science data. He studied the technical specifications for comprehensive scientific inspection under informatization. Furthermore, he proposed comprehensive scientific research systems on resources and environments based on multi-level grids. In the last five years, he has published more than 80 academic papers, four monographs independently and collaboratively and two atlases. He was awarded with the second prize of the National Science and Technology Progress Awards in 2014.

**Recent Representative Publications:**

- (1) Juanle Wang. Earth System Science Data Integration and Sharing: A Standard Perspective. China Meteorological Press, Beijing, 2015.
- (2) Juanle Wang, et al. Remote Sensing of Environmental Changes and Environmental Management in the Poyang Lake Region. Science Press, Beijing, 2015.
- (3) Wang, J. (Ed.). A Remote Sensing Image Atlas on Environmental Changes in China. Science Press, Beijing, 2015.
- (4) Juanle Wang, Yongjie Zhang, Fei Yang, et al. Spatial and temporal variations of chlorophyll-a concentration from 2009 to 2012 in Poyang Lake, China. Environmental Earth Sciences, 2015.
- (5) Juanle Wang, Yujie Zhou, Lijun Zhu, et al. Cultivated land information extraction and gradient analysis for a North-South Transect in Northeast Asia between 2000 and 2010. Remote Sensing, 2014.

- (6) Wang Juanle\*, Sun Jiulin, Yang Yaping, et al. A new approach to research data archiving for WDS sustainable data integration in China, Data Science Journal, 2013.
- (7) Juanle Wang\*, Jiulin Sun, Yunqiang Zhu, et al. A study on the organizational architecture and standard system of the data sharing network of earth system science in china, Data Science Journal, 2013.
- (8) Juanle Wang\*, Hongsheng Li, Eryang Chen, et al. Challenges Facing Chinese Map Libraries and Librarians: From Paper to Digital Worlds and Services. Journal of Map & Geography Libraries, 2014.
- (9) Juanle Wang\*, Jiulin Sun. Some In-depth Thoughts on Resources and Environmental Comprehensive Scientific Expedition Using Gridding Approach in China. Journal of Geo-Information Science, 2015.
- (10) Juanle Wang\*, Hai Lin, et al. A Study of Earth System Science Data Classification for Data Sharing. Advances in Earth Science, 2014.

Last updated: April 13, 2016

1.

**Decree of the President of the People's Republic of  
China**  
No. 82

“The Law of the People's Republic of China on Progress of Science and Technology” has been passed by the 31<sup>st</sup> meeting by the 10<sup>th</sup> Standing Committee of the National People's Congress on 29 December 2017 after revision. The revised “The Law of the People's Republic of China on Progress of Science and Technology” is now announced and will be effective from 1 July 2008 onwards.

President of the People's Republic of China Hu Jintao  
29 December 2007

2.

**General Office of the State Council's Notification on  
the Issuance of Administrative Measures for  
Scientific Data Management**

No. 17 [2018] of the General Office of the State Council

To people's governments of various provinces, autonomous regions, and direct-controlled municipalities, and various departments directly under the State Council,

The “Administrative Measures for Scientific Data Management” has been approved by the State Council and is hereby issued to your department. Please implement these measures carefully.

General Office of the State Council of the People's Republic of China  
17 March 2018

# **System security document of WDC-RRE network**

**Institute of Geographic Sciences and Natural Resources Research,  
Chinese Academy of Sciences**

**March 2016**

## 1. Description of overall network architecture

The network consists of three-level devices, namely, core devices, aggregation devices, and access devices. In addition, it is externally configured in connection with a campus firewall system, forming a three-part architecture as elaborated below.

- An overlay network is constructed between the aggregation and core devices to build a stateless network with a distributed L3 gateway to efficiently inhibit broadcast storms via a reliable mechanism. The access layer devices adopt dynamic VLAN access, and they are uplinked—through TRUNK—to the aggregation layer, where VLAN-to-VXLAN mapping is achieved.
- A flexible user-authentication access mechanism based on 5W1H is adopted. It includes various access scenarios comprised of six dimensions—“who” (who to be connected?), “whose” (whose device to be connected?), “what” (what device to be connected?), “when” (when to be connected?), “where” (where to be connected?), and “how” (how to be connected?).
- A one-to-one communication requirement between the MAC and IP for user terminals is supported throughout the life cycle (e.g., binding to ports based on security requirements). This enables the terminals to always obtain a unique fixed IP regardless of where the terminals move so that subsequent operation and maintenance can be simplified.

## 2. Design of outlet safety zone

### **Load balancing**

Two load-balancing devices are used to provide a complete load-balancing function for the network, allowing for server load balancing and link load balancing.

### **Intrusion prevention**

Two intrusion prevention devices are employed to provide multidimensional integrated security protection for the network. Based on the in-depth analysis (from layer 2 to layer 7) of the network data flow passing through critical paths, the devices



can accurately identify, block, or restrict network attacks or network abuse in real time, e.g., hackers, worms, viruses, Trojans, DoS/DDoS, scans, spyware, protocol anomalies, phishing, P2P, IM, and online games. Moreover, they have a powerful practical bandwidth-management and URL-filtering function.

### 3. Design of core switches

Two high-performance core switches are deployed at the core switching layer to allow for high-speed forwarding of the core service data of the network. Through virtualised cluster technology, the two core switches are virtualised into one and their overall performance is doubled. The core switches are equipped with a redundant power supply system, thereby ensuring high reliability of the core devices.

### 4. Design of firewall system

The firewall system uses the ASPF (Application Specific Packet Filter) application-state detection technology to detect the connection status of an application layer in real time. The system performs several functions such as providing email alerts, attack logs, and flow logs and conducting network management monitoring to assist users with network management. The firewall is equipped with products of 100G performance. It achieves access control, allowing only legitimate packets to pass through and thereby ensuring the security of the internal network while hiding internal network structures from the outside to prevent malicious attacks and sniffing. Moreover, the firewall provides support for the prevention of the following risks: DoS/DDoS attacks, ARP spoofing attacks, illegitimate attacks by TCP packet flags, attacks by large ICMP packets, address/port scan, ICMP redirection or ICMP unreachable attacks, Tracert attacks, IP packets with route record options, Java/ActiveX blocking, and SQL injection attacks. Furthermore, it supports static and dynamic blacklists, MAC binding, security zone control, system statistics, and other security functions.

### 5. Physical security

WDC-RRE takes the following measures to ensure physical security: (1) A separate server room with security doors, windows and locks preventing theft and damage is built for storing infrastructure; (2) The building where the server room is located is supplemented with anti-seismic and fire-fighting equipment, which can



effectively avoid the damage caused by natural disasters such as floods, earthquakes and fires; (3) The central air-conditioning system with stable operation in the server room can ensure indoor constant temperature, thus helping to avoid consequent damage to equipment; (4) All the equipment is metal-shielded. The water pipes, heating pipes, metal doors and windows are shielded to ensure that the system works in an electromagnetically compatible environment.

If there are any suggestions or comments about this document, please contact us:

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