United Nations Educational, Scientific and Cultural Organization
联合国教育、科学及文化组织
International Knowledge Centre for Engineering Sciences and Technology under the Auspices of UNESCO
国际工程科技知识中心 由教科文组织支持

Disaster Risk Reduction Knowledge Service
防灾减灾知识服务

Summary of the Fifth International Workshop for Disaster Risk Reduction Knowledge Service

The Fifth International Workshop for Disaster Risk Reduction Knowledge Service was held online on December 14th, 2021. This workshop was hosted by International Knowledge Centre for Engineering Sciences and Technology under the Auspices of UNESCO (IKCEST) and Section on Earth Sciences and Geo-Hazards Risk Reduction, Natural Sciences Sector, UNESCO, organized by Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences (IGSNRR, CAS) and Disaster Risk Reduction Knowledge Service of IKCEST (IKCEST-DRR), and supported by Integrated Research on Disaster Risk International Programme Office (IRDR IPO), Alliance of International Science Organizations on Disaster Risk Reduction (ANSO-DRR), Deep-time Digital Earth Big Science Programme (DDE), National Earth System Science Data Center. The theme of this workshop was "Open Science and Disaster Risk Reduction".

Mr. Soichiro Yasukaw, Programme Specialist, Coordinator for Disaster Risk Reduction and Resilience, Section on Earth Sciences and Geo-hazards Risk Reduction, Natural Sciences Sector, UNESCO, Mr. Shahbaz Khan, Director of UNESCO Beijing Office, Dr. Ana Persic, Programme Specialist for Science Policy and Partnerships at the Division of Science Policy and Capacity Building at the UNESCO, Dr. Daisy Selematsela, Chair of South African National Committee for CODATA, Mr. Qi Tian, Executive Deputy Director of IKCEST, Ms.Chang Liu, Secretary General of IKCEST, Mr. Zhijun Yi, Bureau of International Cooperation, CAS, Prof. Xing Gao, Deputy Director of IGSNRR, CAS, Prof. Gretchen kalonji,Section on Earth Sciences and Geo-hazards Risk Reduction, Natural Sciences Sector, UNESCO, Former assistant director-general of UNESCO and Dean of the Institute for Disaster Management and Reconstruction (IDMR), Sichuan University-Hong Kong Polytechnic University, Prof. Suju Li, Director of Satellite Application Department of National Disaster Reduction Center of China of Ministry of Emergency Management of P.R.C., Prof. Saini Yang, School of National Safety and Emergency Management, Academy of Disaster Reduction and Emergency Management, and Prof. Guoqing Li, Aerospace Information Research Institute, CAS, attended the workshop. About 70 experts and scholars from China, the United States, Japan, France, South Africa, and the

IKCEST-DRR team attended the workshop. This workshop was simultaneously broadcast online worldwide, attracting more than 830 audiences.

In the opening session moderated by Prof. Juanle Wang, Executive director of IKCEST-DRR, Mr. Shahbaz Khan, Mr. Qi Tian, Mr. Zhijun Yi, and Prof. Xing Gao, made remarks respectively.

The report session was presided over by Dr. Chang Liu. Dr. Ana Persic gave a presentation on "UNESCO Recommendation on Open Science". Prof. Suju Li made a presentation of "International Cooperation on Space-based Earth Observation Services for Disaster Risk Reduction". Dr. Daisy Selematsela, delivered a report entitled "Challenges and Role Players in Transitioning Open Science in Support of Public Good". Prof. Juanle Wang made a report on "Global Disaster Database Review".

The panel discussion and Q&A session were moderated by Prof. Qunli Han, Executive director of IRDR. Mr. Soichiro Yasukaw, Prof. Gretchen kalonji, Prof. Saini Yang and Prof. Guoqing Li, respectively expressed their opinions on Open Science and disaster risk reduction, and then conducted in-depth discussions and exchanges.

During the workshop, Mr. Shahbaz Khan emphasized that this workshop combined Open Science and disaster risk reduction knowledge service, which was very timely and important. This workshop would further enhance the influence of IKCEST-DRR and promote cooperation with more international institutions for disaster risk reduction. Experts discussed the definition of Open Science, its key pillars, values and principles, areas of actions, as well as key challenges facing the application of it. They believed that Open Science is very important in the field of disaster risk reduction and would have a great impact. Open Science needs the joint efforts of universities, publishers, scholars and research institutions, that is, the participation of the government, industry and the public. Open Science should strengthen the data sharing of government funded projects.

The main contents of the keynote report and discussion at the meeting are as follows:

1. Concept and challenges of Open Science

Background of Open Science. UNESCO has adopted the Recommendation on Open Science to promote inclusive, transparent and democratic science. If Open

Science becomes a new normal in future scientific community, the entire scientific process will have more open data, infrastructure and software, creating an open environment for international cooperation in science and technology. Open Science can truly change the game to bridge science, technology and innovation gaps between and within countries by promoting equality for all. At present, the scientific community of various countries believes that Open Science is necessary. However, at the global level, there is still no universal definition and common principles or standards, nor the common understanding of definition, significance and implementation. The standard-setting instrument is currently developed in the form of UNESCO Recommendation on Open Science.

The concept of Open Science. The UNESCO Recommendation on Open Science was adopted by all 193 member states at the General Conference of UNESCO on November 23, 2021. It is the first international normative instrument on Open Science, giving a universal definition and defining the shared values and principles. Open Science builds on four key pillars: open scientific knowledge, Open Science infrastructures, open engagement of societal actors, and open dialogue with other knowledge systems. Each pillar has many different components. For example, open scientific knowledge includes scientific publication, open research and data, open educational resources, open source software and source code. The shared values and principles pave the foundation for Open Science. Action will be taken in seven areas, specifically, to develop an enabling environment, promote a common understanding of Open Science, invest in human resources for Open Science, promote cooperation, invest in Open Science infrastructures and services, foster a culture of Open Science, and promote innovative approaches for Open Science.

The challenges of Open Science. The traditional culture of science needs to be changed, while stepping up capacity building and infrastructure investment. Equality is essential in Open Science. Developed countries are expected to support developing countries through international and regional partnerships. Developing and underdeveloped countries that are undergoing economic transformation also need a lot of support. In less developed countries, university libraries take the lead in practicing Open Science. As many libraries have their own repositories, it is necessary to figure out the costs incurred in open resources and who will bear these costs.

How to practice the Open Science concept. Open Science requires multi-shareholder cooperation, including civil, society, industry and government. UNESCO intends to establish, in the next four years, an international framework for monitoring developments, trends and impacts. In this process, suggestions and discussions from all sides are welcome. To achieve this framework, global Open Science partnerships will be mobilized while supporting the establishment of partnerships at institutional, national, regional, and international levels and the creation of alliances and consortia.

2. International cooperation on space-based Earth observation services for DRR

Space-based Earth observation services for disaster risk reduction is an important application of Open Science. The National Disaster Reduction Center of China (NDRCC) has set up the Integrated Monitoring and Early Warning Department for International Disaster Risk and the Satellite Application Department. Of the seven indicators of the Sendai Framework, four concern disaster damage and three concern disaster risk. Space technologies and Earth observations can greatly facilitate the implementation of the Sendai Framework. Many satellite images are open resources, which makes easier global monitoring for disaster risk reduction.

Five international cooperation initiative are introduced here. 1) The International Charter on Space and Major Disasters, launched in 2000, provides data from numerous satellites under its framework, typically satellite imagery, for post-disaster data processing and analysis, and mapping services. Its data products are disaster maps and disaster loss maps. 2) Relying on open Earth observation data, UN-UN-SPIDE facilitates the use of space technologies for disaster management and emergency management through technical support and information and knowledge sharing. 3) Copernicus is an EU programme aimed at developing European information services based on satellite Earth Observation and in situ (non space) data. This land monitoring network serves emergency management by means of emergency mapping and early warning. 4) GEO's DRR Working Group (DRR-WG), with over 100 members, is one of the largest organizations and initiatives of its kind, consisting of stakeholders from the scientific community. It provides open resources in a wider range, covering Earth observation data, scientific methods, and scientific knowledge,

as well as other open data. Its products mainly include data, information and knowledge. 5) The United Nations Satellite Center-UNOSAT, which is capable of satellite data processing and mapping, focuses on emergency mapping using satellite information. It provides services with rapid access to satellite resources, i.e., Earth observation and satellite imagery.

3. Progress of IKCEST-DRR

The IKCEST-DRR is launched as an IKCEST sub-platform to integrate various knowledge resources such as databases, map libraries, and document libraries for disaster risk reduction. It has successfully joined the Global Alliance of Disaster Research Institutions (GADRI). In view of the background of the Recommendation on Open Science, a web-based survey of 110 disaster databases worldwide was conducted. These databases are from 24 countries or 44 cities around the world. Japan, the United States, and China have relatively large amounts of data. Disasters covered by the databases can be divided to seven types: meteorological and hydrological disasters, geological disasters, marine disasters, biological disasters, man-made disasters, ecological and environmental disasters, and other natural disasters. These databases record the time, location, date, loss, area, and death of disasters, as well as affected country, affected area, amount of damage, etc. High-frequency words in the classification system are earthquake, typhoon, snowfall, blizzard, flood, hurricane, etc. In the future, research will cover more databases and more dimensions based on the principles of discoverability, accessibility, interoperability, and reusability on top of Open Science. A master catalog for disaster database as a knowledge service product will be developed in cooperation with GADRI, and a disaster database knowledge map can be drawn in the near future.

4. Highlights of panel discussion

1) Open Science as a major topic of UNESCO is important for disaster risk reduction. To promote Open Science for disaster risk reduction, the bottlenecks and obstacles need to be identified first. The integration of massive Open Science resources to create added value is also worth discussion.
2) There are many steps for applying Open Science to disaster risk reduction. The first step is monitoring, such as monitoring the occurrence of natural

disasters like earthquakes and other natural disasters. Next, risk assessment should be carried out, which assesses the impact on the economy based on a large amount of data, or more specifically, estimates the human and economic impact caused by natural disasters. Then, solutions are proposed, especially structural solutions, and even social science solutions. This is followed by policy implementation. These four steps all require effective data support, which can be smoothed by Open Science and open data. Open Science should prioritize the results of research funded by the national governments.

3) Monitoring is essential to assess the outcomes of Open Science.
4) The open data for disasters should not be limited to data itself, but take into account knowledge in various forms, such as best practices, articles, reports, tools, and operational software. Such resources, which are very important, should all be integrated into Open Science.
5) Multi-shareholder participation in Open Science is encouraged. Examples should be provided in a timely manner so that the public can see the contribution, value and significance of open data, open knowledge and open courses, especially in the field of disaster risk reduction. Good examples can stimulate participation in Open Science.
6) Open Science requires the concerted efforts of universities, publishers, scholars and research institutions, as well as the engagement of the government, industry and the public. Cultural, copyright and technical issues arising from participant and stakeholder diversity pose challenges, which need to be addressed through sound cooperation mechanisms.
7) Information sharing within the framework of Open Science may also encounter problems. For example, volunteers may process some information by themselves. While observation data is open and free, some geological and socio-economic data for reference are limited.
8) There are problems at the technical level. Data is actually accessed via system, but such systems are not all open or can be accessed via machines. Many of such systems can not support the expanding user base.
9) Regarding the ecosystem for Open Science in disaster risk reduction, it is

challenging to carry out Open Science across different sectors and systems due to coordination between various aspects.

10) Disaster risk reduction is a public issue, involving all aspects of society, economy and nature. Problems would arise if all data for disaster risk reduction are open. In China, for example, open risk information will directly affect asset assessment, land planning, and so on.
11) Regarding cross-border disasters, trust is essential for Open Science to cope with global challenges. Frank and open dialogue are needed on the cross-border issues of floods, earthquakes, air pollution, epidemics, diseases and other disasters.
12) IKCEST should work with other countries to make better use of the available scientific data by establish sound partnerships, including South-South cooperation and North-South cooperation. IKCEST-DRR is expected to provide a leading platform for sharing Open Science topics and ideas, and through the cooperation with more institutions, to further deepen the understanding of the value, principles and specific actions of Open Science in DRR.

The IKCEST-DRR team will further promote the application and practice of Open Science for disaster risk reduction, and improve the capacity and influence of the Disaster Risk Reduction Knowledge Service system (http:// drr.ikcest.org) by stepping up cooperation worldwide.

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Appendix 1: Post of the workshop

Appendix 2: Group photo of some participants