Summary of the Seventeenth Meeting of the Working Group I for Joint Research on Dust and Sand Storms

Hybrid Meeting, Niigata, Japan, 10, October 2024

1. The 17th meeting of the Working Group I (WGI) for Joint Research on Dust and Sand Storms (DSS) under the Tripartite Environment Ministers Meeting (TEMM) was hosted by Japan on 10 October 2024. The representatives of the WGI members from Japan, Korea and China as well as invited representatives from Mongolia participated in this meeting (Annex1: Agenda of the Meeting and List of participants).

2. In Session One, Mr. Yu KAMEI, Director of Office of International Cooperation, Environmental Management Bureau of Ministry of the Environment of Japan (MOEJ), delivered the opening remarks and warmly welcomed the participants. Dr. Atushi Shimizu, from National Institute for Environmental Studies, Japan (NIES) introduced the agenda of the Meeting which was adopted by all participants. There was a commemorative photo session.

3. In Session Two on "Taking stock of discussions and activities" chaired by Dr. Liang LI from China National Environmental Monitoring Centre of Ministry of Ecology and Environment of China (CNEMC/MEE), the two participants made their presentations. Dr. Liang LI gave a presentation entitled "Review on the 16th Meeting of Working Group (I)". In his presentation, he summarized the 16th Meeting of the WGI which was held on 5 December, 2023 through online meeting hosted by China. The main outcomes were the identification of the three DSS events in 2022 and reaching a consensus on a one-year extension period of the current TEMM-DSS WGI MTAP (2020-2024) to synchronize it to next TEMM joint action plan (2026-2030).

4. Following it, Mr. Jeong Hoon CHO, from National Institute of Meteorological Sciences, Korea (NIMS) made a presentation on "The current status of DSS data sharing". According to his report, China, Japan Korea and Mongolia uploaded three DSS cases in 2022. He also introduced issues and suggestion as follows. A deadline for uploading materials should be determined so that the shared observation data can be used in the next meeting's analyses. WGI members proposed every August or 3 months before the WGI meeting. Web-hard storage was almost full and it is inconvenient for non-Korean users to use. It is recommended to move from web-hard to a cloud service or to use the TEMM-DSS online portal so that WGI members can share the observation data through the web-portal.

5. In Session Three on "Progress of the study on DSS monitoring and modeling from each country" chaired by Mr. Takashi MAKI from Japan Meteorological Research Institute, Japan Meteorological Agency (JMA), the four participants made their presentations.

6. First, Mr. Takashi MAKI from JMA gave a presentation entitled “Current DSS monitoring and modeling activity from JMA”. He explained that JMA monitors of aerosol optical thickness and provides information on DSS-related activities, satellite images, model predictions, and ground observations. The Meteorological Research Institute (MRI) develops the Earth System Model (MRI-ESM) for global warming and DSS predictions. The new version (MRI-ESM3) shows reduced dust over-emission. The United Nations (UN) formed a coalition to combat sandstorms in 2019 and designated July 12th as the International Day of Combating Sand and Dust Storms starting in 2023. The World Meteorological Organization (WMO) promotes the SDS-WAS program for DSS. In Asia, CMA acts as the regional center, coordinating district activities and serving as the forecasting center.

7. Second, Mr. Jeong Hoon CHO from NIMS/KMA gave a presentation entitled “Progress of the study on DSS monitoring and modeling in Korea”. He explained the development of a new numerical model for Sand and Dust Storms (SDS) in Korea. It highlights the limitations of the current model (ADAM3) and the need for a new model integrated into the Korea Integrated Model (KIM). The plan includes developing a new Asian dust emission model and a regional-scale forecast model by 2025, launching the new model operationally by 2030. The presentation also introduces a novel method for detecting natural dust source regions using satellite and ground-based measurements, improvements in saltation and vertical dust flux modeling, the application of AI techniques for PM_{10} concentration correction, and updates on the data assimilation system.

8. Dr. Yilin ZHAO, as the third presenter, from Forecast Center, China National Environmental Monitoring Centre (CNEMC) gave a presentation entitled “Simulation and Verification of Medium and Long term Sand and Dust Forecasting. She described that the severe sandstorm process in 2023 had a significant impact on the central and northern regions of China, making it the year with the greatest impact on the North China region in recent years. Considering such situation, the requirements of the government and the public for the technical ability of sand and dust forecasting have also increased. She also explained the forecasting results which indicated that there was a significant sandstorm process that affected Xi'an and Zhengzhou from April 21 to April 24, and the high PM_{10} concentration in Zhengzhou will be occurred in October. In addition, there were three predicted sandstorm weather processes, occurring from April 1-7, April 15-17 and April 24-27, respectively. The first process predicts the highest PM_{10} concentration might be occurred in December in 2024.

9. Fourth presenter was Dr. Purevjav GOMBOLUUDEV from Research Institute of Meteorology, Hydrology and Environment, Mongolia (RIMHE) gave a presentation entitled “Present status of dust monitoring and modeling in Mongolia”. His presentation highlights the locations and parameters of various DSS monitoring sites, the challenges with outdated equipment, and the need for international collaboration to enhance the monitoring system, especially in regions prone to yellow dust storms. The presentation also covers the integration of AI techniques for air pollution forecasting, the use of satellite and ground-based measurements, and the development of new models to improve dust and sand storm predictions. The emphasis was on the importance of international training and exchange programs to build human resource capabilities.

10. In Session Four on “Report from the countries on DSS Events” chaired by Mr. Duk Jin WON from National Institute of Meteorological Sciences, Korea (NIMS), the five presentations were delivered.

11. First, “Analysis on Asian dust cases in 2022” by Mr. Jeong Hoon CHO. He analyzed two significant dust storm events: one in early March and another in mid-December. Both events originated from the Gobi Desert and Inner Mongolia, affecting the Korean Peninsula with high PM_{10} concentrations and prolonged dust durations. The analysis includes surface weather charts, PM_{10} distributions, LIDAR observations, and chemical compositions of dust particles. The study highlights the impact of these dust storms on air quality in Korea and emphasizes the importance of continuous monitoring and analysis for better prediction and management of such DSS events.

12. Following it, “Applicability of low-cost pollen sensor for the detection of DSS events” by Prof. Atsushi MATSUKI (Kanazawa University) introduced the efforts to use low-cost pollen sensors for detecting DSS events in both Mongolia and Japan. The number of stations in Japan conducting visual dust observations has drastically decreased, from 60 to 11, and now only two remain (Tokyo and Osaka). The current situation requires to establish a new ground-based DSS monitoring network to compensate for the discontinued observations. There are high expectations for emerging low-cost sensors to replace the current operational observations. A preliminary intercomparison with conventional high-end optical particle counters (OPCs) revealed that the pollen sensor performed well, showing a strong correlation, particularly with the coarse particle counts measured by the OPCs.

13. As the third presentation, “A Study on the Characteristics of Asian Dust Cases Affecting the Korean Peninsula” by Ms. Migyeong KIM, National Institute of Meteorological Sciences Korea (NIMS). They analyzed the characteristics of an Asian dust event that affected the Korean Peninsula from April 16 to 20, 2024. Originating from the Gobi Desert and Inner Mongolia Plateau, the dust increased soil component concentrations, particularly calcium ions, which led to higher neutralization rates of calcium carbonate in the atmosphere. The study utilized various observation sites and instruments to measure PM_{10} and $PM_{2.5}$ concentrations, chemical compositions, and aerosol mass concentrations. The observational results highlighted the significant impact of Asian dust on air quality and the importance of continuous monitoring and analysis to better understand and predict such events. Future research will focus on estimating the sources of Asian dust using aerosol elemental composition analysis. It was pointed out that the horizontal pattern of DSS event is similar between Korea and Japan.

14. “Report on the field survey in Mongolia in 2024 - Towards stronger cooperation between WG1 and WG2” by Prof. Keiya YUMIMOTO from Kyushu University, Japan was the fourth presenter. He reported details of the field survey conducted in Mongolia in 2024 to enhance cooperation

between two DSS Working Groups (WGI and WGII). The survey aimed to understand the local conditions affecting DSS and to strengthen joint research efforts. The findings revealed that the DSS source regions are highly heterogeneous, with significant variations in vegetation, soil types, and surface conditions. The report emphasizes the need for close collaboration between WGI, which focuses on monitoring and modeling, and WGII, which conducts field observations. The survey's insights will inform the development of a Medium-term Action Plan (2026-2030) and highlight the importance of integrating local observations with model results and satellite data for a comprehensive understanding of DSS dynamics. It was pointed out that DSS event in Mongolia is sensitive to precipitation changes and seasonal changes.

15. Last presenter of Session Four was Dr. Atsushi SHIMIZU from NIES who talked about "A proposal of data sharing period for Asian dust events in 2023". He explained the number of Asian Dust (AD) days in 2023 was relatively high among last 10 years. He also proposed several AD events happened in 2023 in order to select the target of data sharing activities in 2025. They are based on the published monitoring data in China, Korea and Japan. Candidates for data sharing periods proposed by him were (A) April 8-16, (B) April 18-24, (C) May 19-24 and (D) December 6-11, 2023. And he also mentioned the shrinking of JMA dust monitoring.

16. The selection of DSS 2023 cases was discussed in this section led by Mr. Duk Jin WON from , NIMS/KMA. In Korea, there was no observation of Asian Dust in December. It was also mentioned that December is not paid attention by WGI members in China. However, it was pointed out that direct effect of climate change should be considered for analysis of AD event. The participants agreed on the two periods for data sharing of this WGI: April 8-24 [DSS2023-01], May 19-24 [DSS2023-02].

17. In Session five on "Progress on the mid-term action plan (2020-2025)" chaired by Dr. Liang LI (CNEMC/MEE), the secretariate reported the goals and activities and outcomes of the current mid-term action plan, then discussions were made as follows;

- It was recommended that the summary table be re-organized as Goals for MTAP (2020-2025), Activities for MTAP, Expected Outcomes for MTAP and Outcomes.
- It was clarified that the summary table will provide useful information on the Proceeding Report of DSS WGI.
- The possibility of use of cloud storage services to store the observation and modeling data was discussed. For the cloud service for the real time data sharing, participants expressed some uncertainty of security issues and access right issues. A participating country expressed that they would do some necessary investigations on this matter, and ask participants' comments via email.

- It was clarified that encouragement of sharing real-time observation and satellite data to enhance the system is described in current MTAP. At the 16th meeting, consideration on the use of satellite image of external resources was discussed.
- It was pointed out that the TEMM DSS WGI Extended Workshop was held in 2021. This activity should be included in the outcomes.
- It was pointed out that participation on the Workshop on Developing Environmental Cooperation Platform in Northeast Asia organized by CREAS in 2023 and 2024 should be checked.
- The WGI members agreed to prepare the Proceeding Report of DSS WGI on the Mid-Term Action Plan (2020-2025). The preparation of development of report will be continued to discuss via email among WGI participants, as no clear role assignments of writing was decided during the meeting.

18. In Session Six on "Discussion on the NEXT mid-term action plan (2026-2030)" Chaired by Dr. Atsushi SHIMIZU (NIES/JAPAN), MOEJ presented the expected points to be stressed for the next MTAP, as follows:

- Participants are expected to have a common understanding of the future schedule. Since the current MTAP will end in 2025, the next MTAP will be from 2026 to 2030. In order to start promptly in 2026, it is necessary to obtain the agreement among the three countries at the DSS WGI meeting to be hosted by Korea in 2025 and to be approved at the TEMM Director-General Meeting to be hosted by China in the same year. The DSS WG meetings are usually held in the autumn, but in light of the above, it is strongly recommendable to hold the WG meetings in July, before the TEMM Director-General's Meeting.
- The NEXT MTAP for WGI focuses on improving Dust and Sandstorm (DSS) forecasting and monitoring systems and enhancing cooperation with WGII. Key targets include developing short-term, medium-term (S2S), and long-term DSS forecasts using LIDAR, satellite data, and land and vegetation information. Long-term goals emphasize understanding climate change impacts on DSS variations and evaluating past mitigation efforts. It also highlights streamlining monitoring systems by leveraging existing air quality data, satellite technology, and low-cost sensors. Additionally, it calls for strengthened collaboration with WGII to share data from DSS origin points, monitor vegetation changes, and analyze links between DSS reduction and air quality improvements.

19. The participants discussed the targets and activities on the NEXT mid-term action plan (2026-2030). The main points are shown as follows:

- The participant emphasized the importance of developing reliable early warning systems and

adaptation strategies for semi-arid regions, based on numerical models and long-term forecasting.

- IPCC report highlights increased climate-related phenomena in sub-tropical and dry regions. The occurrence of DSS and droughts varies greatly depending on land surface conditions, and the TEMM DSS WG is expected to promote the research on DSS generation due to land surface changes, etc.
- Effective collaboration and communication among countries and groups (WGI and WGII) is essential for reliable forecasts and adaptation measures.
- The participants stressed the importance of cooperation between WGI (providing data) and WGII (implementing countermeasures).
- Despite having knowledge and experience, collaboration is currently lacking. Greater cooperation could lead to better outcomes for people in semi-arid regions.
- It is important to share whether countries have a common understanding of the long-term trends of DSS, including the observed decrease in frequency but increase in intensity. Organizing existing knowledge on the relationship between frequency and intensification is also important. Understanding of past variations in DSS frequency and differences from predictions is important for future forecasting. Additionally, it would be beneficial to evaluate the effectiveness of source control measures implemented under WGII in relation to changes in DSS frequency.
- There are challenges in long-term forecasting and dust event prediction. It would be better to build a common understanding among three countries regarding the short, medium, and long term forecasts.
- More collaboration between WGI and WGII is needed for accurate scenario understanding.
- It was noted that the member countries are facing challenges in short-term forecasting due to limited funds and requires time to develop effective forecast models.
- Future targets include monitoring data as a priority, crucial for developing forecast models and strengthening cooperation with WGII.
- Assessment of effect on future climate change on DSS event is an important research topic.
- Each country has specific important topics, so it's not necessary to implement the common research topics.
- The participants were invited to submit additional comments for the NEXT mid-term action plan (2026-2030) by e-mail.

20. In Session Seven on "Other topics" chaired by Dr Atsushi SHIMIZU (NIES/JAPAN), the Secretariate introduced the proposal from UNCCD expecting a form of cooperation with DSS WGI and II, and create the link of SDS Toolbox to TEMM DSS Online Portal.

21. It was recommended to increase the storage space of the TEMM-DSS portal to store shared data and strengthen cooperation with external DSS related websites could be considered for the NEXT

mid-term action plan (2026-2030).

22. In Session Eight on “Summary”, continuously chaired by Dr. Atsushi SHIMIZU (NIES/JAPAN), the Secretariate presented the 1st draft of meeting summary report and following confirmation by three countries. It was informed that the 1st draft will be circulated by the Secretariate after the meeting. The participants are kindly requested to amend the summary within two weeks after the meeting.

23. For closing remarks, the representatives of China, Korea, Mongolia, Japan acknowledged the efforts and contributions, collaborations made by participants and expressed sincere appreciation to the meeting arrangement by host country.

Annex1: Agenda of the Meeting and List of participants

The 17th Meeting of Working Group (I) for Joint Research on Dust and Sand Storms

(Niigata, Japan)

◈ **Date: October 10th (Thursday) and 11th (Friday), 2024**

◈ **Venue: Minatopia Niigata City History Museum, Niigata, Japan**
https://www.nvcb.or.jp/multilingual/sightseeing/minatopia

◈ **Host: Ministry of the Environment, Japan**

◈ **Meeting language: English**

◈ **DAY 1 (October 10th Thursday)**

10:00 JST (10:00 KST & 9:00 CST) Opening	
Session I Opening Chair: Dr. Atsushi SHIMIZU (JAPAN)	
10:00 – 10:05	**Opening Remarks** Mr. Yu KAMEI, JAPAN
10:05 – 10:15	**Introduction of participants**
10:15 – 10:20	**Adoption of the agenda**
10:20 – 10:30	**Group Photo**
Session II Taking stock of discussions and activities Chair: Dr. Liang LI (CHINA)	
10:30 – 10:45	**Review on the 16th Meeting of Working Group (I)** Dr. Liang LI, CHINA
10:45 – 11:00	**Current status of DSS 2022 Data Sharing** Mr. Jeong Hoon CHO, KOREA
Session III Progress of the study on DSS monitoring and modeling from each country Chair: Mr. Takashi MAKI (JAPAN)	
11:00 – 11:20	**Current DSS monitoring and modeling activity from JMA** Mr. Takashi MAKI, JAPAN
11:20 – 11:40	**Progress of the study on DSS monitoring and modeling in Korea** Mr. Jeong Hoon CHO, KOREA
11:40 – 12:00	**Simulation and Verification of Medium- and Long-term Sand and Dust Forecasting** Dr. Yilin ZHAO, CHINA
12:00 – 12:15	**Present status of dust monitoring and modeling in Mongolia** Dr. Purevjav GOMBOLUUDEV, MONGOLIA
12:15 - 13:30 LUNCH	
Session IV Report from the countries on DSS Events Chair: Mr. Duk Jin WON (KOREA)	
13:30 – 13:50	**Analysis on Asian dust cases in 2022** Mr. Jeong Hoon CHO, KOREA

13:50 – 14:10	**Applicability of low-cost pollen sensor for the detection of DSS events** Prof. Atsushi MATSUKI, JAPAN
14:10 – 14:30	**A Study on the Characteristics of Asian Dust Cases Affecting the Korean Peninsula** Ms. Migyeong KIM, KOREA
14:30 – 14:50	**Report on the field survey in Mongolia in 2024 - Towards stronger cooperation between WG1 and WG2** Prof. Keiya YUMIMOTO, JAPAN
14:50 – 15:10	**A proposal of data sharing period for Asian dust events in 2023** Dr. Atsushi SHIMIZU, JAPAN
15:10 - 15:30	**Break**
Session V	**Progress on the mid-term action plan (2020-2025)** Chair: Dr. Liang LI (CHINA)
15:30 – 16:10	**Review on the activities during 2020-2024**
16:10 – 16:30	**Discussions on the Potential Cooperative Activities between the WGI and WGII** (Secretariate)
Session VI	**Discussion on the NEXT mid-term action plan (2026-2030)** Chair: Dr. Atsushi SHIMIZU (JAPAN)
16:30 – 17:30	**Proposed points for the Next mid-term action plan (MTAP) (2026-2030)** **Detailed milestones to develop** (Secretariate)
Session VII	**Other topics** Chair: Dr. Atsushi SHIMIZU (JAPAN)
17:30 – 17:40	**Discussions on the other topics**
Session VIII	**Summary** Chair: Dr. Atsushi SHIMIZU (JAPAN)
17:40 - 17:50	**Making a meeting summary report** (Secretariate)
17:50 - 18:00	**Closing remarks** Representative from Korea Representative from China Representative from Mongolia Representative from Japan
19:00 –	**Reception**

◈ DAY 2 (October 11th Friday)

9:30 - 11:30	**Excursion (ACAP Facility)**
11:30 - 13:00	**LUNCH**
13:00 - 14:30	**Excursion (The Niigata Saitou Villa)**

The list of participants of 17th meeting of DSS WGI

(In-person/Online participants)

Name	Nationality	Organization	Position	In-person /Online
Mr. Jun Zhou	China	Department of International Cooperation, Ministry of Ecology and Environment	Director	Online
Dr. Liang Li	China	Ambient Air Quality Monitoring Department, China National Environmental Monitoring Centre	Senior Engineer	In-person
Dr. Yilin Zhao	China	Forecast Center, China National Environmental Monitoring Centre	Senior engineer/ Chief forecaster	In-person
Ms. Sarah Kwon	Korea	Interational Cooperation Bureau, Ministry of Environment	Senior Researcher Expert	Online
Mr. Jeong Hoon Cho	Korea	Global Atmospheric Watch and Research Division, National Institute of Meteorological Sciences	Researcher	In-person
Ms. Migyeong Kim	Korea	Global Atmospheric Watch and Research Division, National Institute of Meteorological Sciences	Researcher	In-person
Mr. Duk Jin Won	Korea	Global Atmospheric Watch and Research Division, National Institute of Meteorological Sciences	Director	In-person
Dr. Hee-Jung Yoo	Korea	Global Atmospheric Watch and Research Division, National Institute of Meteorological Sciences	Researcher	Online
Mr. Yu Kamei	Japan	Office for International Cooperation, Environmental Management Bureau, Ministry of the Environment	Director	In-person
Ms. Yumi Yasuda	Japan	Office for International Cooperation, Environmental Management Bureau, Ministry of the Environment	Deputy Director	In-person
Mr. Katsuyuki Yamada	Japan	Environmental Pollution Control Office, Environmental Management Bureau, Ministry of the Environment	Deputy Director	Online

Mr. Takatoshi Yoshimoto	Japan	Environmental Pollution Control Office, Environmental Management Bureau, Ministry of the Environment	Researcher	Online
Ms. Yurika Ito	Japan	International Forest, Dryland and Polar Ecosystem Conservation Measures Section, Natural Environment Planning Division, Natural Environment Bureau, Ministry of the Environment	Section Chief	Online
Dr. Atsushi Shimizu	Japan	Regional Environment Conservation Division, National Institute for Environmental Studies	Prime Senior Researcher	In-person
Mr. Takashi Maki	Japan	Department of Atmosphere, Ocean, and Earth System Modeling Research, Meteorological Research Institute	Section Head	In-person
Dr. Masao Mikami	Japan	Promotion of Meteorological Research Division, Japan Meteorological Business Support Center	Acting Division Director	In-person
Dr. Nobuo Sugimoto	Japan	Earth System Division, National Institute for Environmental Studies	Visiting Researcher	Online
Prof. Keiya Yumimoto	Japan	Research Institute for Applied Mechanics, Kyushu University	Professor	In-person
Prof. Atsushi Matsuki	Japan	Institute of Nature and Environmental Technology, Kanazawa University	Assocaite Professor	In-person
Ms. Sukhee Bayartsetseg	Mongolia	Integrated Policy Planning Department, Ministry of Environment and Climate Change	Senior Analyst in charge of Desertification and Land degradation	In-person
Dr. Purevjav Gomboluudev	Mongolia	Climate Research Division, Research Institute of Meteorology, Hydrology and Environment	Scientific Secretary	In-person

(Meeting Secretariate)

Name	Nationality	Organization	Position	In-person /Online
Mr. Ryuji Tomisaka	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Deputy Director General	In-person
Dr. Fan Meng	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Deputy Director General	In-person
Dr. Ken Yamashita	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Head, Planning & Training Dept.	In-person
Dr. Keiichi Sato	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Head, Atmospheric Research Dept.	In-person
Dr. Hiroyuki Sase	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Head, Ecological Impact Research Dept.	Online
Dr. Junichi Kurokawa	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Head, Data Management Dept.	In-person
Dr. Meihua Zhu	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Chief Senior Researcher, Planning & Training Dept.	In-person
Mr. Hiroki Yotsuyanagi	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Senior Researcher, Ecological Impact Research Dept.	In-person
Ms. Miho Tamura	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Chief, Planning & Training Dept.	In-person
Mr. Katsutoshi Uehara	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Administrative Staff, Planning & Training Dept.	In-person
Ms. Eriya Tsuchiya	Japan	Asia Center for Air Pollution Research, Japan environmental Sanitation Center	Administrative Staff, General Affair Dept.	In-person