

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

Online Meeting, Beijing, China, 5 December 2023

1. The 16th meeting of the Working Group I (WG I) for Joint Research on Dust and Sand Storms (DSS) under the Tripartite Environment Ministers Meeting (TEMM) was hosted by China virtually and on-site on 5 December 2023. The representatives of the WG I members from Korea, Japan, 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, chaired by Dr. Liang LI from China National Environmental Monitoring Centre of the Ministry of Ecology and Environment of China (CNEMC/MEE). Mr. Xiaoyan MENG from China National Environmental Monitoring Centre (CNEMC) delivered the opening remarks and warmly welcomed the participants. Dr. Liang LI introduced in-person participants as well as online participants from four countries including Korea, Japan, China, and Mongolia. Then, he went over the agenda of the one-day meeting which was adopted by all participants. There was a commemorative photo time.
3. In Session Two on "Taking stock of discussions and activities" chaired by Dr Shimizu Atsushi from National Institute for Environmental Studies, Japan (NIES), two participants made presentations. Ms. Seungsook Shin from NIMS/KMA gave a presentation entitled "Review on the 15th Meeting of Working Group (I)". In her presentation, she summarized the 15th Meeting of the WG I which was held from 1st to 2nd November 2022 at Jeju Lotte City Hotel hosted by Korea. The main outcomes are the identification of the three DSS events in 2021 and the agreement for publishing the data catalogue at the TEMM DSS online portal. Shared data for research on four DSS events in 2020 were listed. Three scientific articles on DSS have been published by TEMM-DSS members since 2022. As a DSS-related meeting, the 17th Tripartite Director General Meeting on DSS was also introduced. It was held from 25th to 26th September 2023 at Nagoya Convention Hall hosted by Japan.
4. Ms. Sumin Kim from NIMS/KMA made a presentation on the current status of DSS

2021 data sharing. According to her report, each country uploaded three DSS cases in 2021. Two are in March and one is in May. The second case is the most severe dust event among DSS 2021. She mentioned that the web hard storage is almost full and suggested to download all data by each country before emptying the storage. A discussion followed on whether there was a need to accumulate and share data and the use of a "Data catalog" on the TEMM website. The use of URLs (about the satellite images, eg. JAXA website) also mentioned as a way to share data.

5. In Session Three on "Progress of the study on DSS monitoring and modeling from each country" chaired by Dr. Liang Li from CNEMC/MEE, the four participants made their presentations. Dr. Maki gave the first presentation entitled "Recent DSS modeling research activities from Japan". Mr. Takashi MAKI presented an overview of modelling studies on DSS being conducted by MRI. In the Gobi Desert, a significant increase in DSS emissions was found in association with a decrease in snow cover in early spring and late autumn in scenarios with more accelerated global warming. This was also observed in Central Asia and North America in the Northern Hemisphere, but these regions did not show the significant increase in friction velocity seen in the Gobi Desert. There was also an improvement in DSS reproducibility by introducing stone coverage effects into the regional aerosol model. He also presented an overview and future directions with regard to the SDS-WAS being implemented by the World Meteorological Organization.
6. Mr. Jeong Hoon Cho from NIMS made a presentation entitled "Recent improvements of Asian Dust Aerosol Model version3 (ADAM3) in KMA". According to his report, KMA has improved the Asian dust emission scheme to increase the threshold wind speed based on soil moisture. The results showed that predicted PM₁₀ concentrations matched observations better than the experiment using the previous version of the Asian dust emission scheme. And also, KMA updated observation error for three-dimensional variational data assimilation system based on characteristics of observation sites.
7. Ms. Yinlin ZHAO from CNEMC/MEE gave a presentation on the topic of Performance of domestic and foreign sand source areas in simulation of transport contribution of different sand and dust models. Said in her presentation, different numerical models of sand and dust, combined with different atmospheric chemical schemes and different parameterization schemes for sediment generation, have resulted in inconsistent peak times, significant differences in peak concentrations, and low accuracy in concentration simulation for the same research target city. In terms of contribution to external transmission, different model simulation results have a relatively large contribution in

absolute concentration, and some calculation results even exceed the actual total PM₁₀ concentration monitored locally in Beijing. There are also certain differences in contribution percentages.

8. Dr. Munkhtsetseg Erdenebayar from The National University of Mongolia, Mongolia made a presentation entitled "Percentage of coarse particles captured by BSNE during DSS2019 in Mongolia". Said in her presentation, we collected transported dust and sand samplings using BSNE sand traps during dust events that occurred between the period of April 23 and June 11, 2019. All samplings captured at the 4 bins (those mounted at different heights) were classified into 6 distinct sizes of particles. Our preliminary results showed that medium to coarse particles are mainly composed DSS2019, and those reflect the soil texture of the source area. Moreover, percentages of medium to coarse particles were larger at the low heights. In contrast, percentages of fine to very fine particles gradually increase as a collecting height (BSNE traps bin height) increase. This preliminary result demonstrates a pattern of percentages of coarse particles during DSS2019 at some point. However, we need more investigation and research in depth.
9. In Session Four on "Report from the countries on DSS Events" chaired by Dr. Hyun-Suk Kang from NIMS/KMA, the seven presentations were delivered. First, Dr. Hee-Jung Yoo from NIMS/KMA gave a presentation entitled "Observation and Analysis of DSS2021 Case". This study presents the observation and analysis results of the DSS2021 case in NIMS/KMA. Dr. Hee-Jung Yoo selected analysis of a DSS case observed in 2021. DSS2021-02 case is a case that affected the Korean Peninsula for 80 hours and 10 minutes from March 28th to April 1st, 2021, and the maximum PM₁₀ mass concentration was 1,491 $\mu\text{g}/\text{m}^3$.
10. Dr. Shimizu Atsushi from National Institute for Environmental Studies, Japan (NIES) made a presentation entitled "Characteristics of Asian Dust Observed over Japan in 2021". Daily variations of dust extinction coefficient below 1 km observed by AD-Net lidars in 2021 were shown to confirm the dust situations during 2021 data sharing periods. Dust extinction in 2022/2023 were also displayed for interannual comparison. Several major dust events in 2021 were analyzed using AEROS (surface atmospheric environment monitoring system in Japan) and JMA records to identify the time evolution of Asian dust at independent prefectures. He stressed an importance of the non-spring dust with an analysis of fall dust event in November 2021.
11. Ms. Ming HU from Shanghai Environmental Monitoring Center (SEMC), China made a presentation entitled "Size distribution and chemical composition of particulate matter in Shanghai during a dust transport event". The presentation firstly introduced the dust

storms affecting Shanghai during the past 8 years, and then detailed described a dust storm case in March 2021, which resulted one moderate pollution day and one lightly pollution day in Shanghai. Compared with the non-dust period, the proportion of crustal elements in PM during the dust event increased by 27 percentage points and the particles smaller than 1 μ m decreased, but the number concentration and mass concentration of particles larger than 1 μ m increased significantly.

12. The period of DSS observation data to be studied by the joint research was discussed in this section led by Dr. Hee-Jung Yoo from NIMS/KMA. In his presentation, Korea suggested two dust cases among four cases occurred in South Korea: two in the springtime and two in the wintertime. After the presentation, the participants shared the view and agreed on three periods for data sharing of this WG I: 2-7 March 2022 [DSS2022-01], 24-30 April 2022 [DSS2022-02], and 10-16 December 2022 [DSS2022-03].
13. Dr. MATSUKI Atsushi from Kanazawa University made a presentation entitled "Aerosol magnetite concentrates in PM during Asian dust events: a new proxy for natural dust loading and Fe-solubility". His recent effort to evaluate the sensitivity of environmental magnetism to dust storm event was presented. The aim of the study was to establish the basis for a new dust storm detection method. The magnetic intensity of coarse aerosols collected in the remote background site (Noto) in Japan was investigated and compared with metal and isotopic compositions. It was reported that aerosol magnetization is primarily controlled by the magnetite content and remarkably enhanced during DSS events. It was suggested that the influence of DSS and anthropogenic emission can be identified simply by comparing aerosol mass and magnetization. There is a potential for the aerosol magnetism to be used as a new measure of dust loading as well as Fe solubility in the atmospheric aerosols.
14. Senior engineer Yuanzhe REN and engineer Yawen TANG from the Department of Ecology and Environment of Inner Mongolia Autonomous Region gave a speech entitled "The impact of dust weather processes on air quality in northern China and its prediction and forecasting techniques". The content of the speech includes the definition of sand and dust weather in China, the source and basic meteorological characteristics of sand and dust weather in China, the transmission path, the spatial and temporal distribution characteristics, and the impact on air quality in northern China, and summarizes the relevant influencing factors and classification of sand and dust weather forecasts.
15. Dr. SUGIMOTO Nobuo from the National Institute for Environmental Studies gave a

speech entitled "Dust Hot Spots Seen in Himawari-8 Dust RGB Data and Needs for a High-Resolution Regional Model with High-Resolution Surface Condition Data". In his presentation, a dust event where dust hot spots were clearly seen in the Dust RGB data from the geostationary satellite HIMAWARI-8 was presented. Dust hot spots were observed around Lake Hulun located about 200 km west of Hulunbeier. However, CFORS (a regional chemical transport model) did not reproduce any emission in this area. CFORS instead showed relatively large dust emission in Horqin Desert in the same period, but no dust emission was observed in Dust RGB. The results suggest the needs for a high-resolution regional model with high-resolution surface data. Such a model would also be useful for linking the activities of WGI and WGII.

16. In Session Five on "Discussion on the mid-term action plan (2020-2024)" chaired by Dr. Maki Takashi from Meteorological Research Institute, Japan. Dr. Ken YOSHIKAWA, Emeritus Professor, Okayama University, reported the results of the DSS WGII Extended Workshop that was hosted to facilitate the collaborations between the DSS WGII and WGI by Japan on 7th November 2023 in hybrid format. DSS WGII experts from China, Korea and Japan and DSS WGI experts from China and Japan as well as the invited speakers from Mongolia, China and FAO of the United Nations participated in the workshop. The participants exchanged views and discussed on technical and scientific aspects on DSS related matters with a view to enhance and identify scientific collaboration on DSS countermeasures to tackle the DSS issues. He appreciated the great inputs and cooperation from the DSS WGI members to the WGII Extended Workshop.
17. Dr. SHIMIZU Atsushi from National Institute for Environmental Studies, Japan (NIES) made a presentation entitled "Proposed Activities for the Next Mid-Term Action Plan (MTAP)". He suggested one year extension of the current TEMM-DSS WG1 MTAP(2020-2024) to synchronize it to next TEMM joint action plan (2026-2030). This extension also keeps enough time to discuss and exchange the ideas related to next MTAP (2026-2030) in 2024. He also recommended that the WG1 meeting in 2025 should finalize MTAP before TEMM-DGM. As a result of discussion, all participants finally accepted the suggestion..
18. Session six was on "Summary". Dr. Liang Li from CNEMC/MEE chaired the session. The four countries made discussions and finalized the meeting summary at the Session.
19. In the last session was closing remarks, the representatives acknowledged the efforts and contributions, collaborations made by participants and expressed sincere appreciation to the host country. Dr. LI made an acknowledgement for the efforts and contributions of all the participant countries and a special thanks to Japan side for their

help for using the online meeting software Webex. Each country representative gave their brief summary. Among others, Mr. KAMEI Yu, from MOEJ, as the host country of the next 17th WG I Meeting, made an acknowledgement for the efforts and contributions made by all participants. He also mentioned the potential collaboration with EANET and the possibility of holding next year' s WG1 meeting at ACAP in Niigata, Japan. Detailed date, venue, timeline would be further consulted among Japanese FPs.

Annex1: Agenda of the Meeting and List of participants

The 16th Meeting of Working Group (I) for Joint Research on Dust and Sand Storms

(Beijing, Online Meeting)

□ **Date : December 5th (Tuesday), 2023**

Host: China National Environmental Monitoring Center/MEE, P.R.CHINA

□ **Meeting tool: WebEx**

□ **Meeting language: English**

□ **DAY (December 5th Tuesday)**

09:00 CST (10:00 KST & JST) Opening

Session I Chair: Dr./Mr./Ms. Li liang. (CNEMC/MEE, CHINA)

09:00 - 09:05 Opening Remarks

Mr./Ms. Officers/Leader, P.R. China (CNEMC/MEE, CHINA)

09:05- 09:10 Introduction of participants

Introduce experts and officials from participating countries

09:10 - 09:15 Adoption of the agenda

09:15 - 09:20 Group Photo

Session II Taking stock of discussions and activities

Chair: Dr Shimizu Atsushi (JAPAN)

09:20 - 09:35 Ms. Seungsook Shin, Review on the 15th Meeting of Working Group (I) (KOREA)

09:35 - 09:50 Ms. Sumin Kim, Current status of DSS 2021 Data Sharing (KOREA)

09:50 - 10:05 Break

Session III Progress of the study on DSS monitoring and modeling from each country

Chair: Mr./Ms. Li liang. (CNEMC/MEE, CHINA)

10:05 - 10:25 Dr. Maki Takashi, Recent DSS modeling research activities from Japan (JAPAN)

10:25- 10:45 Mr. Jeong Hoon Cho, Recent improvements of Asian Dust Aerosol Model version3 (ADAM3) in KMA (KOREA)

10:45 - 11:05 Ms. Yinlin Zhao, Performance of domestic and foreign sand source areas in simulation of transport contribution of different Sand and Dust Models (CHINA)

11:05 - 11:30 Dr. Munkhtsetseg Erdenebayar, Percentage of coarse particles captured by BSNE during DSS2019 in Mongolia (MONGOLIA)

11:30 - 13:30 LUNCH
Session IV Report from the countries on DSS Events Dr. Hyun-Suk Kang (KOREA)
13:30 - 13:50 Dr. Hee-Jung Yoo, Observation and Analysis of DSS2021 Case (KOREA)
13:50 - 14:10 Dr. Shimizu Atsushi, Characteristics of Asian Dust Observed over Japan in 2021 (JAPAN)
14:10 - 14:30 Ms. Ming Hu, Size distribution and chemical composition of particulate matter in Shanghai during a dust transport event (CHINA)
14:30 - 14:50 Dr. Hee-Jung Yoo, Selection of DSS2022 cases (KOREA)
14:50 - 15:10 Dr. Matsuki Atsushi, Aerosol magnetite concentrates in PM during Asian dust events: a new proxy for natural dust loading and Fe-solubility (JAPAN)
15:10 - 15:40 Mr./Ms. Ren Yuanzhe & Tang Yawen., The impact of sand and dust weather on air quality in northern China and its prediction and forecasting techniques (CHINA)
15:40 - 15:45 Dr. Nobuo SUGIMOTO, Dust Hot Spots Seen in Himawari-8 Dust RGB Data and Needs for a High-Resolution Regional Model with High-Resolution Surface Condition Data (JAPAN)
15:45 - 16:00 Break
Session V Discussion on the mid-term action plan (2020-2024) Chair: Mr. Maki Takashi. (JAPAN) 16:00-16:15
Discussion on the cooperation with two working groups (DSS WGII Extended Workshop) Dr. Yoshikawa Ken, Report on the DSS WGII Extended Workshop in Nov. 2023 16:00-16:10
Discussion on the mid-term action plan (2020-2024) and next mid-term action plan Dr Shimizu Atsushi, Proposed Activities for the Next Mid-Term Action Plan (MTAP) China/Korea/Japan 16:10-16:30
Session VI Summary 16:30-17:20 Chair: Dr. Li Liang (CNEMC, CHINA)
Dr. Li Liang (CHINA) 16:30-17:20 Making a Meeting summary
Session VII Closing Remarks (CHINA etc.) 17:20-17:30

List of the participants:

Name	Nationality	Organization	Position
Wenjing JIN	China	Department of International Cooperation, Ministry of Ecology and Environment of the People's Republic of China (MEE)	Officer
Buying WANG	China	Department of Ecological and Environmental Monitoring, Ministry of Ecology and Environment of the People's Republic of China (MEE)	Officer
Liang LI	China	Air Quality Monitoring Division, CNEMC	Senior Engineer
Xiaoyan MENG	China	Air Quality Monitoring Division, CNEMC	Deputy Director
Yilin ZHAO	China	Environmental quality forecast center, CNEMC	Senior Engineer
Hanyang LIU	China	FECOME	Project Assistant
Ren Yuanzhe	China	Department of Ecology and Environment of Inner Mongolia Autonomous Region	Senior Engineer
Tang Yawen	China	Department of Ecology and Environment of Inner Mongolia Autonomous Region	Engineer
Ming Hu	China	Shanghai Environmental Monitoring Center	Senior Engineer
Insook Kang	Korea	Ministry of Environment, Korea	Deputy Director
So-Jung You	Korea	Ministry of Environment, Korea	International Cooperation Advisor

Name	Nationality	Organization	Position
Hyun-Suk Kang	Korea	National Institute of Meteorological Sciences(NIMS)	Director
Seungsook Shin	Korea	National Institute of Meteorological Sciences(NIMS)	Senior Researcher
Jeong Hoon Cho	Korea	National Institute of Meteorological Sciences(NIMS)	Researcher
Sumin Kim	Korea	National Institute of Meteorological Sciences(NIMS)	Senior Researcher
Hee-Jung Yoo	Korea	National Institute of Meteorological Sciences(NIMS)	Researcher
Woojeong Lee	Korea	National Institute of Meteorological Sciences(NIMS)	Researcher
Migyeong Kim	Korea	National Institute of Meteorological Sciences(NIMS)	Researcher
Misun Kang	Korea	National Institute of Meteorological Sciences(NIMS)	Researcher
SHIMIZU Atsushi	Japan	National Institute for Environmental Studies (NIES)	Chief Senior Researcher
SUGIMOTO Nobuo	Japan	National Institute for Environmental Studies (NIES)	Visiting Researcher
MAKI Takashi	Japan	Meteorological Research Institute	Head
MATSUKI	Japan	Kanazawa University	Associate Professor

Name	Nationality	Organization	Position
Atsushi			
MIKAMI Masao	Japan	Meteorological Business Support Center	Senior Chief Engineer
YUMIMOTO Keiya	Japan	Kyushu University	Professor
YOSHIKAWA Ken	Japan	Okayama University	Professor Emeritus
KAMEI Yu	Japan	International Cooperation Office, Environmental Management Bureau, Ministry of the Environment	Director for International Cooperation
GOMI Kayoko	Japan	International Cooperation Office, Environmental Management Bureau, Ministry of the Environment	Deputy Director
YASUDA Yumi	Japan	International Cooperation Office, Environmental Management Bureau, Ministry of the Environment	Section Chief
YAMADA Katsuyuki	Japan	Environmental Pollution Control Office, Environmental Management Bureau, Ministry of the Environment	Deputy Director
YOSHIMOTO Takatoshi	Japan	Environmental Pollution Control Office, Environmental Management Bureau, Ministry of the Environment	Researcher
HASHIDATE Kaori	Japan	Environmental Management Division, Environmental Management Bureau, Ministry of the Environment	Staff
Munkhtsetseg Erdenebayar	Mongolia	The National University of Mongolia	Senior Researcher

