Mid-term Action Plan of Working Group I for Joint Research on Dust and Sand Storms (2026-2030)

I. Background

Following the agreement at the 8th Tripartite Environmental Ministers Meeting (TEMM), China, Japan, and Korea have initiated joint research on Dust and Sand Storms (DSS) under the priority area of "Air quality improvement". The joint research program on DSS comprises two working groups. The first working group (hereafter WG I) has focused on establishing a DSS monitoring network and developing an early warning system to detect the formation and transport of DSS in East Asia. The second working group (hereafter WG II) has focused on implementing countermeasures in the source areas of DSS. Since 2009, WG I has invited a Mongolian expert as an observer.

The WG I has established three Mid-Term Action Plans (hereafter MTAP) from the beginning to the present, including the 1st (2008-2014), 2nd (2015-2019), and 3rd (2020-2025) MTAP. Through the past MTAPs, the program has achieved the following research outcomes and collaborations:

First, three countries shared their observational data and dust model results for the selected dust events, as well as their information about monitoring and forecasting systems. The sharing and accumulation of data on DSS events served as the foundation for various studies. Secondly, shared data contributed to the validation of DSS transport models and the improvement of their accuracy. It was also demonstrated that the data can be used to identify the transport paths from source to downstream areas and to contribute to the evaluation of impacts on health and vegetation through clarification of chemical and physical characteristics. Finally, the research outputs of WG I were compiled into international journals.

At the 18th WG I meeting held on 30th June ~ 1st July 2025, in Seoul, Korea, the future plan of WG I was discussed in order to enhance the cooperation on sharing observation data and establishing a joint early-warning system of DSS. This document hereby presents the work plan for the next term, the 4th MTAP (2026-2030), of WG I for joint research on DSS.

II. Goals

Upon the discussions at the 18th WG I meeting, the following are determined as the goals of the next MTAP:

1. **Continuation of previous WG I activities**
2. **Encourage the expansion of data sharing scope and enhanced data sharing system**
3. **Encourage the enhancement of the DSS forecast and early warning systems**
4. **Enhancement of the streamlining of DSS monitoring system**

5. **Enhancement of cooperation with WG II**
6. **Strengthening collaborative efforts with Mongolia**
7. **Encouragement of the participation of outreach research groups**

To achieve these goals, 7 main activities are decided as described in Section Ⅲ. The detailed timeline, milestones and resource mobilization for the 4th MTAP will be determined in the coming 19th WG I meeting which will be held in 2026.

III. Main Activities

1. Continuation of previous WG I activities

In order to improve a DSS early warning system, WG I continues data sharing, validation and sharing of the results of the model simulation, and publication of the research results in the scientific journals.

2. Encourage the expansion of data sharing scope and enhanced data sharing system

The WG I has endeavored to share the maximum possible data from the existing or new monitoring stations to study and analyze selected Asian dust cases. The WG I encourages expanding the scope and duration of observational data sharing over the next five years. In particular, observational data that can be useful for streamlining the DSS monitoring system, such as gas and aerosol concentrations from the air quality monitoring station data and visibility from the measuring instrument. The WG I also shares forecast data and research results along with observational data. The agreed-upon data or data catalogue will be listed on the TEMM DSS online portal, and the data will be managed through a data-sharing platform, such as a cloud server. The WG I will enhance the capability of the data sharing system as needed, The WG I strives to improve the preservation and processing of historical shared data.

3. Encourage the enhancement of the DSS forecast and early warning systems

In recognition of the complex challenges posed by forecasting and managing DSS variations on Sub-Seasonal to Seasonal (S2S) scales, particularly in the context of climate change and its multifaceted impacts, WG I advocates the following strategic actions:

3-1. Advancement of short-term forecasting: Enhancing the current early warning system and its accuracy, prioritizing the effective utilization of DSS monitoring data such as LIDAR, alongside land information, vegetation analysis, and hotspot data to strengthen predictive capabilities.

3-2. Refinement of S2S forecasting: Improving the precision and dependability of S2S forecasts for DSS events to more accurately predict and mitigate their regional impacts.

3-3. Projection of long-term DSS trends: Employing climate scenarios derived from the Coupled Model Intercomparison Project (CMIP) to analyze the effects of climate change and drought on DSS source regions and their downwind trajectories.

3-4. Examination of historical dynamics: Investigating historical relationships among DSS occurrences, climatic conditions, and anthropogenic influences to enhance understanding of long-term variability and assess the effectiveness of past mitigation efforts.

4. Enhancement of the streamlining of DSS monitoring system

The efforts of the three countries for the prediction of DSS and the improvement of the early warning system have been steadily continued. It is encouraged that by sharing the real time observation data on the origins and routes of the DSS, the development of the DSS early warning system to be further advanced.

The World Meteorological Organization (WMO) currently defines visual observation as the standard method for detecting DSS phenomena. However, due to the increasing deployment of automatic measuring instruments and the decreasing number of personnel at observation sites, visual observation is becoming less common. To address this challenge, WG I encourages the development and advancement of alternative DSS detection methods and technologies. This includes the effective utilization of existing air quality monitoring station data, as well as emerging systems such as low-cost sensors. By elaborating and refining these alternative identification methods, we aim to enhance the accuracy and reliability of DSS detection while reducing reliance on visual observations.

5. Enhancement of cooperation with WG II

The importance of collaboration between WG I and II in sharing data and findings has been recognized at the Tripartite Director General Meeting and discussed at the WG level.

WG I will continue the discussion on collaboration with WG II, exploring possibilities such as holding joint workshops, launching new joint research projects. Additionally, we aim to establish periodical or irregular proceedings that consolidate these papers as well as joint reports with WG II. Through the cooperation between the WGs, we aim to achieve a deeper understanding of changes in the DSS source regions due to climate change and improve the DSS early warning system by reflecting the highly heterogeneous surface conditions.

6. Strengthening collaborative efforts with Mongolia

As emphasized in the Joint Declaration of the 9th China-Japan-Korea Trilateral Summit, strengthening cooperation with Mongolia is a key priority. Under the 'Trilateral+X Cooperation' framework, the three countries are committed to working closely with Mongolia to tackle and reduce the impact of DSS across East Asia.

To this end, WG I will continue its engagement to explore strategic avenues for deepening Mongolia's involvement, thereby fostering a robust, multilateral approach to achieving these shared environmental goals.

Also, through this kind of cooperation, Mongolia will contribute to the development of the technology that can predict and evaluate the effects of Asian dust.

7. Encouragement of the participation of outreach research groups

Sand and dust storms (SDSs) are a global issue, not limited to specific countries. In response, the United Nations (UN) has designated a ten-year period from 2025 to 2034 dedicated to combating SDSs, as highlighted in its recent resolution. The WMO has been coordinating joint research and operations on SDSs through the SDS Warning Advisory and Assessment System (SDS-WAS) since 2007, which brings together research institutes and operational agencies from around the world. Recently, the UN Convention to Combat Desertification (UNCCD) has also developed a global SDS source map, demonstrating the international effort to address this problem. To contribute to international programs and expand our research capabilities, WG I encourages the participation of various research groups involved in related programs, such as university research institutes as well as national research institute-based participation. WG I also encourages collaboration with other international organizations including the UNCCD to exchange information and create reciprocal links to each other's Web sites. In this context, WG I aims to promote the sharing of knowledge and foster a unified understanding of the causes and consequences of past DSS variations, thereby contributing to the development of collaborative solutions.

IV. Expected Outcomes

1. **Enhanced data sharing system for joint research**
2. **Enhanced DSS forecast and early warning systems, including both short- and long-term DSS predictions**
3. **Enhancement of the streamlining of DSS monitoring system**
4. **Enhancement of cooperation with WG II**
5. **Enhancement of collaboration with Mongolia**
6. **Encouragement of the participation of outreach research groups**