# Prediction of changes in DSS emission using the Earth System Model of the Meteorological Research Institute

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1. Background
Yellow sand (DSS) is emitted in the arid regions of East Asia and arrives near Japan mainly in the springtime. The impact around Japan is limited to traffic disruptions and impact to people's lives, but near the source of the dust, it can have a significant social and economic impact, including human deaths. DSS is said to affect not only human activities but also climate and weather, and advanced numerical prediction centers are actively conducting tests to introduce aerosols including DSS into numerical models. Although DSS has such important social, economic, and scientific impacts, we do not yet have sufficient knowledge of how the amount of DSS emitted and transported to downstream areas will change with future climate change. This is because the generation of DSS is very sensitive to wind speed near the ground surface and ground surface conditions (snow cover, soil moisture, sand quality, vegetation, etc.), making accurate prediction of these factors extremely difficult. In this study, we attempted to analyze the results of future predictions of DSS emissions and various parameters related to it using the predictions of the Coupled Model Intercomparison Project (CMIP6) of the Earth System Model (MRI-ESM2) developed by the Meteorological Research Institute.
2. Method
MRI-ESM2 (Yukimoto et al., 2019) is an Earth system model that combines various modules such as atmosphere, ocean, land, aerosol, and atmospheric chemistry via couplers. The resolution of MRI-ESM2 in the CMIP6 experiment is TL159 (120 km horizontal grid spacing) for atmosphere, TL95 (180 km horizontal grid spacing) for aerosols, and T42 (280 km horizontal grid spacing) for atmospheric chemistry. The number of ensemble members is 5, and the past reproduction experiments were conducted from January 1850 to December 2014, and after that, 7 different SSP scenario experiments were conducted until December 2100 (of which only SSP370 has 5 ensemble members). The aerosol model is MASINGAR mk-2 (Tanaka et al., 2005), which has been developed by the Meteorological Research Institute. This model treats dust (DSS), sea salt, sulfate, black carbon, and organic aerosols assuming external mixing. For the natural aerosols, dust and sea salt, the model calculates the amount of dust and sea salt emitted based on the various surface conditions calculated by MRI-ESM2. For dust, which is the theme of this study, we adopt a scheme to calculate the amount of dust emission based on parameters such as friction velocity, soil moisture, vegetation, and snow cover.
3.Results and Discussion
The trend of DSS emission amount in the Gobi Desert is shown in Figure 1. Although there was a slight increase in many scenarios and ensembles throughout the entire period, an increasing trend was observed in many experiments during the spring season, which is the main period of DSS emission. In terms of correlations with factors closely related to DSS emission, the correlation with friction velocity was the largest throughout the entire period, and correlations with soil moisture and snow equivalent water were also observed in the spring season (Table omitted). Further analysis of these factors will be conducted and a presentation will be made on the presentation.
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