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Responses of tropical cyclone activities to stratospheric aerosol injection

Mincheol Moon and Seung-Ki Min

Division of Environmental Science & Engineering, Pohang University of Science and Technology

Stratospheric Aerosol Injection (SAI) has been proposed as a solar climate intervention strategy capable of offsetting part of the global warming induced by greenhouse gas emissions. The ARISE-SAI-1.5 experiment, conducted with CESM2(WACCM6) under the SSP2-4.5 background forcing, represents a state-of-the-art, multi-objective SAI scenario designed to maintain global mean temperature and interhemispheric thermal gradients near mid-21st century levels. This study aims to investigate how such a realistically designed SAI deployment could influence global tropical cyclone (TC) activity. Using the ARISE-SAI-1.5 ensemble and its corresponding baseline SSP2-4.5 simulations, we will apply an objective detection and tracking algorithm to assess changes in TC frequency, intensity, and spatial distribution across all major ocean basins. The analysis will further explore links between projected TC changes and large-scale environmental parameters, including vertical wind shear, mid-level humidity, and sea surface temperature. By focusing on both global and basin-specific responses, this research will provide a physically consistent assessment of how SAI-driven modifications to the climate system could alter TC-related risks. The findings are expected to offer valuable insights for evaluating the benefits and trade-offs of SAI in the context of extreme weather and climate risk management.

Keywords: Tropical Cyclones, SAI, ARISE-SAI-1.5, OWZP, Climate change