



DEPARTMENT OF EARTH AND ATMOSPHERIC SCIENCES

INDIANA UNIVERSITY
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Dear Editor,

We are pleased to submit “*The impacts of Stratospheric Aerosol Injection on Antarctic ice loss depend on injection location*” for exclusive consideration by the *Journal of Geophysical Research – Atmospheres*. In this manuscript, we present a comprehensive study to simulate and assess the effectiveness of using Stratospheric Aerosol Injection (SAI) that minimizes global mean temperature (GMT) to slow projected 21st century Antarctic ice loss. To our knowledge, only one previous study has examined the impact of SAI on Antarctica (McCusker et al., 2015), which leaves many research questions to be revisited and new questions to be answered.

Here, we concentrate on the atmospheric and oceanic response to eleven different SAI strategies and clearly state which SAI strategies would slow Antarctic ice loss. We find that injecting sulfate precursors only at the Equator or at a single latitude in the northern hemisphere will increase shelf ocean temperatures pertinent to ice shelf basal melt relative to the turn of the 21st century. However, injecting at a single latitude in the southern hemisphere would minimize this temperature change and provide relative cooling across many areas of the continental shelf. Nonetheless, it is more plausible that a deployed injection strategy will inject at multiple latitudes to meet several climate objectives. Therefore, we use the single latitude strategies to better understand the output of four multi-latitude injection cases. We show that an SAI case which injects between 30°N and 30°S with most of the injection in the southern hemisphere and that cools GMT to 0.5°C above the pre-industrial has the best potential to slow future ice loss.

The manuscript details dynamics that lead to changes in surface ice accumulation and shelf ocean temperature across the entire continent. Furthermore, we articulate processes and results that may be model or experiment dependent and consider those implications. Our intent, as shown through the information-rich text and figures, is to educate SAI scientists and decision makers about Antarctic dynamics so that they can make informed future research plans and decisions.

The manuscript contains an Abstract with 250 words, Main Text with 10,700 words, 17 Main Figures, 1 Main Table. Also included is the Supporting Material with 17 figures.

Best regards,

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