

Dear Professor Visioni,

Thank you very much for your review, which helped us improve the manuscript. We appreciate the time you invested and address all your comments in blue color below.

Best,

Andrea & Sandro & Co-Authors

This is a rather important paper, neatly discussing the assumption behind SOCOL microphysical scheme and how changes in the assumptions that are valid in background conditions need to be re-assessed for simulations of SAI. The addition of the Pinatubo simulations and their discussion in light of the SAI finding is very nicely done. The manuscript is perfect for GMD and is exceptionally well written, so I think it should be promptly published. I have a just a few minor comments below.

Great abstract. I would suggest using terms now more widely used, like Solar Radiation *Modification* and just SRM (or SAI) instead of strat-SRM, which is confusing (in my opinion). You also never use the term “strat-SRM” in the manuscript, so a bit pointless.

Thanks for pointing this out. We stick to the term “Climate Intervention”.

Line 112: “Neighboring size bins differ by molecule number doubling” this description is slightly confusing

We agree, since it is only a doubling for one of the two neighbors. We rewrote to: “Subsequent mass bins differ by molecule number doubling”

Line 182: Do they actually follow G4? G4 didn't explicitly mention how to inject (only indicating to do it just like in the models' simulations of Pinatubo), and used RCP4.5, while SSP5-8.5 is more recent than that. Are you talking about G6, which is based on SSP5-8.5 but goes to SSP2-4.5 surface temperatures, and prescribed injections at 10N-10S? If so, need to correct here. Right reference is more correctly Kravitz et al. (2015).

We corrected the scenario specifications: “These so-called “regional injections” are complemented by an example of a “point injection” performed with SOCOLv4 (see section 2.2) injecting 5 Tg(S) yr<sup>-1</sup> in the form of SO<sub>2</sub> at the same vertical extent but constrained to a region from 10°N to 10°S at the equator only emitting at the 0° meridian. These “point emission” scenarios with constant injection rates were motivated by the G4 GeoMIP experiment described in Kravitz et al. (2011). However, instead of RCP4.5 GHG and injections of 5 Mt SO<sub>2</sub>/yr as specified in Kravitz et al. (2011), we used SSP5-8.5 GHG and injected 5 Mt/yr S in the form of SO<sub>2</sub>, which is consistent with Wunderlin et al. (2024). The transient SSP5-8.5 boundary conditions allow us to explore the sensitivity of surface temperature to the call sequence in a fully coupled ESM.”

Line 277-290: Again, some clarity needed in which scenario you used.

We corrected to: “To overcome this limitation, we performed a 5 Tg(S) yr<sup>-1</sup> “point injection” scenario with the CN setup (S5p\_CN\_20, see section 2.3) using the ESM SOCOLv4, a coupled model which shares the same exact aerosol module as SOCOL-AERv2 (see methods).”

Line 345: why only the “extreme” one? You also consider a 5 Tg case which is not extreme by Pinatubo-like eruption standards.

We changed to : “So far, our study has highlighted the impacts of the microphysical settings for continuous injections in climate intervention scenarios.”

Line 361: use exponential notation to avoid confusion here please (as you do elsewhere!).

Agree, we changed to exponential notation.

Line 369: a good example “of” how...

Thanks for spotting, this was corrected.

Line 450: old habits die hard... you use “solar geoengineering” here while saying it’s a misleading term in line 34 and promising you’ll use the term “climate intervention” in your work. I don’t mind “geoengineering” as a term, but if you – and free to do so – then abide by the promise not to use it, so as to not to confuse the reader!

Thanks for pointing this out again. We are sticking to our promise now, and use the term “climate intervention”.