

Atmos. Chem. Phys. Discuss., referee comment RC1 https://doi.org/10.5194/acp-2021-877-RC1, 2021 © Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.

## **Comment on acp-2021-877**

Anonymous Referee #1

Referee comment on "Impacts of three types of solar geoengineering on the Atlantic Meridional Overturning Circulation" by Mengdie Xie et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-877-RC1, 2021

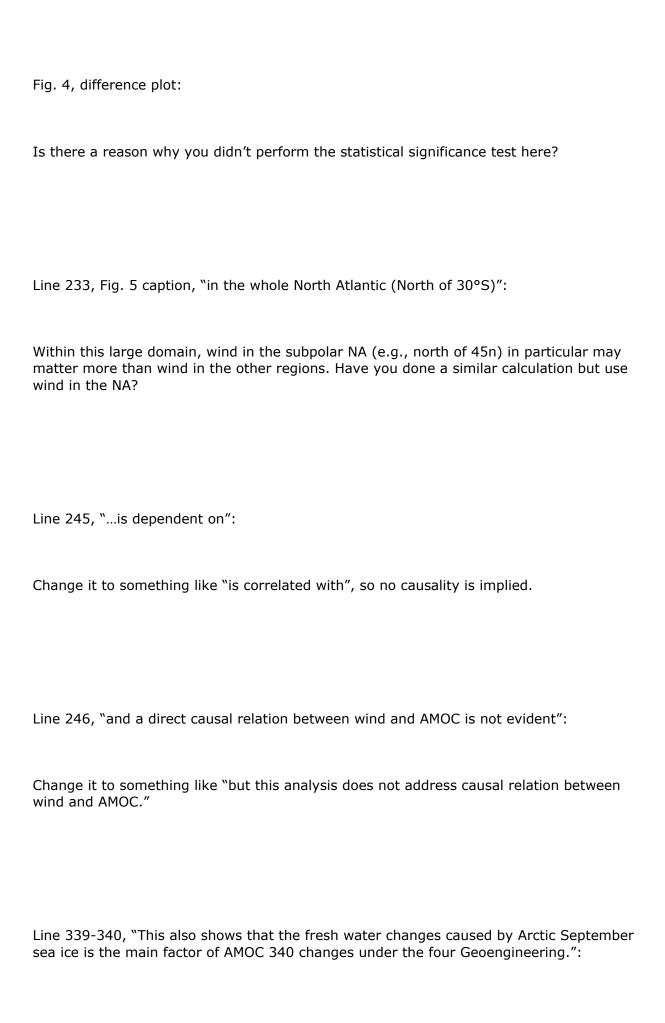
Review on "Impacts of three types of solar geoengineering on the North Atlantic Meridional Overturning Circulation" by Xie et al.

The authors study the efficacy of different geoengineering on ameliorating the AMOC reduction under GHGs forcing using ESM simulations. While I suspect the author's analyses were constrained by what's available in the GeoMIP output, could you explain why G1 and G1oa were used to counter 4xCO2 forcing whereas G4 and G4cdnc were to counter RCP4.5 scenario? The authors are fully aware that GHG forcing in 4xCO2 and RCP4.5 is very different, and the geoengineering forcing strength is also different between G1, G1oa, G4, G4cdnc. These differences render the comparison across G1/G1oa and G4/G4cdnc somewhat arbitrary, and this is true whether you are talking about an absolute anomaly (e.g., table 2), or a ratio (as in equation 3), or ratio's ratio (as in equation 4). But, if it has to be done this way, you should provide more justification and/or motivation. Alternatively, you can compare G1 with G1oa, and G4 with G4cdnc without the crossgroup comparisons. The presentation is otherwise generally clear, except for a few places (see specific comments below).

## **Specific Comments**

Line 187-188, "Generally, mitigation of AMOC weakening under G4cdnc is more than with G4, but weaker than G1 solar dimming":

But mitigation of G1 solar diming was applied to 4xCO2 not RCP4.5, so this comparison is not apples-to-apples.



Please clarify. What about the heat flux you just described? Is it not a main factor?
Line 354-356, "the specific MCB measures simulated to counteract RCP4.5 are relatively more effective than those under G4. This might mean that specific measures under G4cdnc appear more effective than those simulated under G4 stratospheric aerosol injection,":
If I read it correctly, the second sentence largely repeats the first sentence, right? Please clarify.
Line 356-357, "but the forcing applied under G4cdnc was not specifically designed to
match the net radiative forcing of the G4 SAI.":
Precisely. So what does the comparison tell you?
Line 360-361, "we cannot simply look at anomalies, but instead can compare the responses as a ratio,":
Ratio is not less arbitrary than anomalies. Is there a reason why G1 was not done to counter RCP4.5 as well like G4 was?
Technical Corrections
Line 12, cross out "North" before "Atlantic Meridional"

