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PEEB 7

Description Of The Methods / Analysis of Pros & Cons (no particular order):

1. Sunshades in space: If sunshades are used, then a surface area of 35 700 km2 would need to be added each year. This would mean that as radiative forcing increased, the only way to keep up with it would be by adding expensive sunshades to increase area. The RF would be RF=4.23 W m2. According to Science Daily, the L-1 Orbit "would form a long, cylindrical cloud with a diameter about half that of Earth, and about 10 times longer. About 10 percent of the sunlight passing through the 60,000-mile length of the cloud, pointing lengthwise between the Earth and the sun, would be diverted away from our planet. The effect would be to uniformly reduce sunlight by about 2 percent over the entire planet, enough to balance the heating of a doubling of atmospheric carbon dioxide in Earth's atmosphere." Although this approach seems be effective, it is not necessarily feasible in the long run. The costs may outweigh the benefits, as it is not economically feasibly to keep expanding the area of the space sunshade.
2. Stratospheric Aerosols: Instead of using sulfate aerosol, it may be in the best interest to use soot aerosol or manufactured aluminum particles. Stratospheric soot aerosols are only effective as a net cooling agent at high stratospheric altitude, and they could reach an estimated RF=1.86 W m2. For aluminium aerosols, the Rf ranges from 0.5-1 W m2, depending on altitude.
3. Increase cloud albedo - Mechanical: In order to offset 3.71 W m2 from doubling CO2, it requires a planetary albedo increase of 0.011. Surface albedo modification geoengineering allows for both near-field and far-field changes in climate. A con is that these surface albedo modification techniques don't offer a full proof solution and could possibly be harmful in the long run.
4. Increase cloud albedo - Biological: The application of this technique likely yields RF=0.019 W m2. Surface albedo modification geoengineering allows for both near-field and far-field changes in climate. A con is that these surface albedo modification techniques don't offer a full proof solution and could possibly be harmful in the long run.
5. Increase desert albedo: The application of this technique to 2% of earth's surface likely results in 2.75 W m2 radiative forcing. This technique may be " inherently limited in their potential and would create a much more heterogeneous radiative forcing than propositions for space-based "reflectors" and enhanced stratospheric aerosol concentrations".
(https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2011JD016281)
6. Increase grassland albedo: The application of this technique likely results RF=0.61 W m2. This technique may be " inherently limited in their potential and would create a

much more heterogeneous radiative forcing than propositions for space-based “reflectors” and enhanced stratospheric aerosol concentrations”. (https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2011JD016281)

7. Increase cropland albedo: The application of this technique yielded in RF=0.24±0.09 W m2, which was considerably lower compared to the estimate. This technique may be “ inherently limited in their potential and would create a much more heterogeneous radiative forcing than propositions for space-based “reflectors” and enhanced stratospheric aerosol concentrations”.(https://agupubs.onlinelibrary.wiley.com/doi/pdf/10.1029/2011JD016281)
8. Increase human settlement albedo: The application of this technique likely results in RF=0.16 W m2. This method is likely to decrease atmospheric temperature, serving as a good compliment to mitigation.
9. Increase urban albedo: The application of this technique likely results in RF=0.0081 W m2. This method is likely to decrease atmospheric temperature, serving as a good compliment to mitigation.
10. Afforestation and reforestation: The final application of this technique yield in RFfinal↑0.27 W m2. D. Ramsey from New York, NY, asks “I know that deforestation is causing us to lose valuable carbon-dioxide absorbing forestland globally at an alarming rate. But I rarely hear about reforestation as a means to confront climate change. Does it offer too little hope for making a dent in the problem? Or might a large-scale reforestation effort in the United States or elsewhere make a significant difference?” From the research that I have found, reforestation can have a large impact, but in the long run.
11. Bio-char production: In the strong mitigation scenario, the application of this technique likely results in RFfinal↑0.52 W m2. Not only does bio-char production help out with mitigation in the long run, but it also increases fertility, helps crop growth, and improves other soil properties.
12. Air capture and storage:The application of this technique likely results in RFfinal↑1.43 W m2. Carbon capture + its storage will let us to continue using fossil fuels while also substantially reducing emissions of greenhouse gas emissions to the atmosphere.
13. Generic considerations for ocean fertilization: This technique will likely not work because it may cause an imbalance of nutrients found in the ocean, disrupting the systems.
14. Phosphorus addition to the ocean: The application of this technique will likely result in RFfinal↑0.83 W m2. Currently, this is a rather controversial technique, and different scientists have different takes on it.
15. Alleviating nitrogen limitation: The application of this technique likely results in RFfinal↑0.38 W m2, on the millennial time scale.

16. Ocean iron fertilisation: The application of this technique likely results in RFfinal↑0.29 W m2 because of the strong mitigation situation.
17. Enhance upwelling: The application of this technique likely results in RFfinal↑0.028 W m2, on the millennial timescale.
18. Carbonate addition to the ocean: The application of this technique likely results in RFfinal↑0.46 W m2 in this strong mitigation scenario.

Explanation / Rankings:

There are very few geoengineering options have the potential to counteract >3Wm2 when only employed by themselves. Geoengineering should be used in addition to mitigation in order to cope up with environmental issues. Some shortwave geoengineering measures such as stratospheric aerosol injections are probably going to be most useful when it comes to counteracting mitigated CO2 radiative forcing. Also, cloud albedo or grassland/desert/cropland albedo techniques could be used to do the same, achieving -1.0 W m2 possibly if used in combination. However, the downside of these shortwave techniques are that they have to be continuously employed, meaning that if they were suddenly put to a halt, there could be a dramatic change in climate. Also, since resources have to continuously be replenished, it is likely very expensive. “On the nearer time horizon of 2050, a minimum atmospheric CO2 of 450 ppm in the absence of geoengineering would give ←2.6 W m2 radiative forcing”. Thus, the only way to bring the climate back to its preindustrial state on the 2050 timescale would be by setting up large scale projects with shortwave geoengineering techniques. There are also methods that can be considered in combination to have long lasting effects. For example, bio-char combined with afforestation and reforestation show great potential, achieving -0.8 W m2. Besides these techniques, carbon addition to the ocean can be used as a long-term storage of carbon dioxide or other forms of carbon to either mitigate or defer global warming and avoid dangerous climate change. Ultimately, this would slow down the accumulation of greenhouse gases.

Overall, if I were to rank the methods, taking all factors into account, I would put sunshades, air capture and storage of liquid CO2, and albedo methods at the top. After that, I would consider phosphorus addition to the ocean and Bio-char to be the best options. I would consider Increasing ocean alkalinity because it goes from being ineffective on the century timescale to becoming more effective in the long run. This is because on the millennial timescale it plays a big role in climate cooling. Similarly, increasing nitrogen and iron fertilisation has many long term effects, but compared to short term effects, it is not nearly as important as afforestation. I believe that these are the factors that should be taken into consideration and applied to the Maldives.

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